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THE RADIOLOGIST AS A PHYSICIAN*

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Dr. Widmann, Dr. Bishop, Members of the American Roentgen Ray Society, Ladies and Gentlemen:

I CANNOT adequately express to you my feelings at being installed President of this Society, the second oldest radiological society in the world. This is an honor to which I have never aspired but it is none the less appreciated. I can truthfully say I am happiest when I have the approbation and confidence of my friends and colleagues. This thought is perhaps best expressed by the words of MacNiele Dixon in introducing his Gifford Lectures and which were also used by Smithers in his presidential address before the British Institute of Radiology, "If it be said, and it is no more than truth to say, that I owe my position here to the friendship of my colleagues, I wish this to be added, that I take more pleasure in the regard of my friends than in any honor that could be done me."

Since it is the custom for the incoming president of the Society to discourse on a subject in which he is particularly interested, I have chosen as the title of my rambling remarks, "The Radiologist as a Physician." In times like these, when the place of the radiologist in the hospital and in the care of patients in private practice is under close scrutiny, it is perhaps wise to do a little introspective thinking on the subject. Soon after the discovery of x-rays—or roentgen rays, as we now call them—their medical use became apparent and it was natural that physicians in general and certain of them in particular should turn their energies and ingenuities to the development of this new modality. Very soon so much of their time was spent in this field that they came to be known as "x-ray men." The connotation at that time was entirely satisfactory because it was obvious that these men had the same general and specialized training as their confrères and were so respected. With the increase in use of the roentgen rays for diagnosis and later, with radium, for treatment, those who wished to specialize in roentgenology or "x-rays" were prone to shorten the preliminary general post-graduate training or to begin specialization immediately after internship. Along with this emphasis on the technical aspects of diagnosis and therapy, it became more and more difficult for us to keep up with the advances in clinical medicine. We came to be more and more "x-ray men" without that real clinical

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touch and approach which is necessary if one is to be a physician in the true sense of the word. This is one but by no means the only reason why our colleagues and the administrators of hospitals where we worked began to look upon us as super-technicians who should be in nominal charge of x-ray departments rather than as radiologic consultants in the same sense that the surgeon and internist are consultants. Much of this attitude was brought on by the radiologist himself who shrank from accepting clinical responsibility. He became content to hazard opinions based on the films or roentgenoscopic examination alone and was willing to be told to which patients he should give radiation—and even at times how many days he should treat the patient. This was not unnatural because the background of his training in medicine and surgery was not sufficiently broad to allow him to accept this responsibility. However, as Rigler and others have pointed out, in roentgen diagnosis one cannot function properly unless he is willing to do more than simply describe the findings on a roentgenogram and without interpreting them in terms of probable pathologic processes. The fact that at times no diagnosis or even a tenable impression can be given has no bearing on the question.

Unfortunately, most of the cases seen by a radiologist are referred to him by his colleagues and friends. I say "unfortunately" because this tends to make him beholden to them for his practice. This aspect is a powerful force in keeping the docile radiologist and his thinking "in line" with that of the referring physician. This is, of course, more likely to be true of those referring physicians and surgeons who have difficulty admitting to either themselves or their patients that they do not have all of the answers, and who wish to appear omniscient to their patients. Many such men are not looking for a real consultant but for someone to confirm their preconceived ideas. This condition of affairs is deplorable but true of some of the internist-surgeon-radiologist relationships. Diagnostic impressions may even at times be warped and radiation therapy for malignant disease may lose most of its meaning. From such we must protect our patients. I would suggest, therefore, that no matter under what arrangements we may practice, we maintain the privilege of having patients come direct to us, especially for consideration of radiation therapy. Let us beware of selling our birthright for a mess of pottage.

After a good many years, due in part to an active interest on the part of the American College of Radiology, the practice of radiology has again been defined and accepted as the practice of medicine, although there should never have been any question regarding its place in medical practice. Therefore, whether we like it or not, we are physicians with the same privileges and responsibilities as the most active and vocal practitioner of any branch of medicine. These responsibilities we cannot shirk and still maintain our self-respect as radiologists and physicians. In other words, we must practice medicine, be conversant with problems of the internist, surgeon, gynecologist, urologist, pediatrician, and others, and be prepared to advise with them regarding the diagnosis, care and treatment of all of our patients. An alert radiologist should know as much and usually more about the basic aspects of the treatment of fractures, for instance, than most surgeons. He will see practically all cases for a number of men while generally each surgeon or orthopedist will see only his own cases in a given area. The results of various procedures, therefore, should be better known to him than to an individual surgeon. That this is no idle hope is illustrated by the case of a well known radiologist who is frequently asked by the referring physician not only to determine whether or not a fracture is present but who is also asked to suggest the best method of reduction and even at times to execute the procedure. This is as it should be. The responsibility of the radiologist should not end with accepting a patient for a diagnostic or therapeutic procedure. There are many times when he

can be of assistance to his colleague in discussing not only the diagnosis but also general therapeutic procedures. Every effort should be made to exclude or delay examination on those patients who, because of their condition, should be immediately put to bed. The chances of recovery of a patient with a skull fracture may be compromised by an over zealous houseman who wishes to have everything done before his chief arrives. An alert diagnostic radiologist may even deter an enthusiastic young staff surgeon from operating on a child with a foreign body in the gastrointestinal tract when all experience indicates that it will pass naturally. He must also try to protect the patient from the habit of some consultants who use the department of radiology as a waiting space and request examinations just to keep the patient occupied while he is waiting.

A diagnostic radiologist who runs a busy department is seriously handicapped by not being able to interview all of the patients whose films he is to interpret and this lack should be at least partially made up by insisting on adequate clinical data being put on the diagnostic roentgenologic request. Without these data, the radiologist is wise to defer his impression until such are forthcoming. It is quite obvious, of course, that interpretations in certain cases can be made from the roentgenograms alone. To first scan the film without aid of clinical data is to sharpen one's diagnostic acumen, but more sound information is likely to be given the consultant if complete clinical data are available. Whenever it is possible the patient should be questioned before roentgenography, and the roentgenoscopic examination should always be used as an opportunity to talk to the patient and do a pertinent physical examination.

It is constantly stressed and generally recognized that a knowledge and appreciation of the normal roentgenographic findings is most important. Are we not prone at times, however, to forget what Kornblum emphasized years ago, that is that the normal blood cytology, blood chemistry, urinary excretion data, hepatic function studies, and so forth, and so on, are also important as a background for roentgen interpretation? Since diagnostic radiology touches practically every branch of medicine, and since the patient's whole symptom complex is important and usually pertinent, the more pathology and clinical medicine the radiologist knows, the more he will be a real consultant. Toward this end, many of us would do well to emulate one of our respected colleagues who is said to read a one-volume text of internal medicine each year.

When practicing therapeutic radiology, how much of a physician does the radiologist have to be? First, let me emphasize that irradiation for malignant disease is a major procedure and is not devoid of a percentage of morbidity. This can be decreased, however, by close observation of the patient and care of details. Who among us would refer a patient for care of a mammary carcinoma which we had discovered while she was under treatment for carcinoma of the cervix and then tell the qualified surgeon what to do and how to do it? Are not some of us at times guilty of being dictated to regarding what kind and how much treatment we should give a certain patient? How many times against our better judgment do we succumb to pressure to give further irradiation to a patient who has already received the maximal safe dose or for a condition that will almost certainly not be influenced by the treatment? There is no question that we can benefit from discussion with members of another staff but the decision regarding the type, duration and amount of irradiation is our responsibility, and we should not be unduly swayed by a desire to please the referring physician or surgeon. The responsibility for unfavorable reactions is ours and we will find it unwillingly shared by our colleagues.

In the minds of a significant number of radiologists there seems to have developed a subconscious attitude or feeling that they should be interested in the physical condition of the patients only through the me-

dium of the referring physician. Is it not worth recalling that we all started at the same point at graduation and that there is nothing particularly mysterious about the use of a laryngeal mirror, a vaginal speculum, proctoscope, cystoscope, or even a microscope, to say nothing about the intelligent use of one's hands? Constant use of these methods of examination will keep us in closer touch with clinical medicine generally and the condition of our specific patients. A radiologist should be just as able to detect metastatic lymph nodes in the neck or axilla as the surgeon, and his examination of the pelvis should be as revealing and significant as that of the gynecologist. In this connection, it is only fair to admit that our consultants may also have a sound knowledge and at times great experience in interpreting roentgenograms in their own particular field of medicine or have a good background against which to discuss irradiation, and that much may be gained for the patient by a frank discussion of all points of view.

As a general statement, a therapeutic radiologist should not treat a patient for malignant disease without making as complete an examination of all pertinent areas as possible. It is obvious that operative findings cannot be rechecked but one will be much more intelligent regarding the care of the patient postoperatively if he is present at the operation and feels or sees the extent of the disease. May I suggest that surgical procedures are not as esoteric as some wielders of the scalpel would have us believe and that the thought or even sight of blood need not greatly dismay us. The sight of a radiologist on an operating team should not be unusual in institutions where considerable intracavitary or interstitial irradiation is given. It is much easier to direct the surgeon regarding the positioning of the radioactive foci when contamination is no problem and, of course, the radiologist may actually place the radioactive material. Dosage should always be the responsibility of the radiologist. There is great value in teamwork in the treatment of malignant neoplasms, but it is more and more obvious that the patient who is receiving irradiation naturally looks to the radiologist as "his doctor" and this compliment carries with it no small amount of responsibility. Reactions, both local and general, are not uncommon when irradiation is given for the eradication of malignant disease. The responsibility for these reactions rests with the radiologist who must decide with the help of the referring physician what measures are to be taken to combat them or whether irradiation must be discontinued.

In other words, if we as radiologists are to secure and maintain our place as consultants and practitioners of medicine we must work toward that end. If we do not keep pressure on ourselves we will become more and more .looked upon as supertechnicians, readers of "x-ray pictures" and "vendors of x-ray and radium by the dose"—to quote Douglas Quick. If we allow ourselves to be pushed or stampeded into such a position or overcome by inertia we may find ourselves in the quite unenviable position of being dictated to and controlled by the internists and surgeons who send us our patients or by hospital administrators who may wish to control all fiscal aspects of radiology. On paper, it says that the practice of radiology is the practice of medicine, but if we do not assume the role of physicians but act as technicians only, we can expect to be treated as such. We will then have no one but ourselves to blame. There is unlikely to be a road back and the road ahead will be full of thorns.

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ELECTRONIC AMPLIFICATION OF THE ROENTGENOSCOPIC IMAGE*†

PRESENT STATUS OF MOON'S SCANNING TUBE METHOD

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APPROXIMATELY two and one-half years ago (in 1948), Professor Robert J. Moon, of the Institute of Radiobiology and Biophysics of The University of Chicago, conceived a system for the electronic amplification of the roentgenoscopic image by means of a scanning roentgen-ray tube[1] and two years ago he described his system at the Chicago meeting of this Society[2]. The purpose of this paper is to report the progress that has been made in Moon's project during the past two years. That progress is considerable and important but does not yet include perfection of a practical clinical instrument or even the basis for rational guesses as to when such an instrument will be perfected.

GEOMETRICAL CONSIDERATIONS

In a recent paper[3] Moon describes quantitatively the design of the tube and the system on which it operates. His conclusions can be summarized as follows:

1. The focal spot of the electrons on the surface of the target must approximate a mathematical point—that is, have as small a diameter as possible.
2. It is desirable to operate the tube continuously at 100 ma. and 125 kv.

From our experience with conventional roentgen-ray tubes, these two requirements seem to be mutually exclusive but actually it can be shown that a tube so designed and so operated will not suffer injury of its target and the real problem turns out to be the concentration of the electrons in a very small point rather than the design of a target that will withstand the heat produced by them. The apparent paradox is resolved by two pieces of information:

A. The pinpoint electron beam will move across the face of the target at a speed of approximately 100,000 cm. per second, whereas the speed in rotating anode tubes is approximately 1 to 2 thousand cm. per second.
B. It has long been known and recently British experimental physicists have shown that the permissible specific loading of a focal spot rises rapidly as the diameter of the spot approaches zero. When focal spots have moderately large diameters, points near the center (where the temperature is highest) dissipate heat into the copper backing only directly backward over a path perpendicular to the face of the target, whereas in pinpoint focal spots heat flows into the copper radially through a solid angle of 2π steradians (one-half of a sphere).

It is hoped that scanning tubes now under construction will have focal spots as small as 25 microns, and it is certain that the diameters of their spots will not be more than 100 microns. The means by which this fine focus is accomplished will be described below under the heading of "Scanning Roentgen-ray Tubes."

Up to this point we have been speaking of the electron beam, but we now turn to the roentgen-ray beam, the size of which is determined by the size of the pinhole in the lead barrier and its distance from the target of the roentgen-ray tube (assuming a focal spot smaller that the pinhole). Here

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† Professor Moon's work has been supported in part by grants from the United States Public Health Service, the Office of Naval Research, and the industrial sponsors of the Institute of Radiobiology and Biophysics.

one must strive to balance advantage against disadvantage. A low percentage of statistical fluctuation of roentgen-ray quanta in the scanning beam is desirable and, all else being equal, is accomplished by using a large pinhole. But high resolving power also is a desirable feature in the system and, all else being equal, it requires a small pinhole. A pinhole of the order of 100 microns turns out to be a reasonable compromise—larger, perhaps up to 250 microns, if it is placed far from the target of the tube—or somewhat smaller if it proves desirable to place it closer to the target of the tube.

By Moon's calculations, the optimum integrating time for the system turns out to be 2/10 of a second and this value fortunately is well adapted to the physiology of human vision.

SCANNING ROENTGEN-RAY TUBES

The first scanning roentgen-ray tube used by Moon and the one on which all

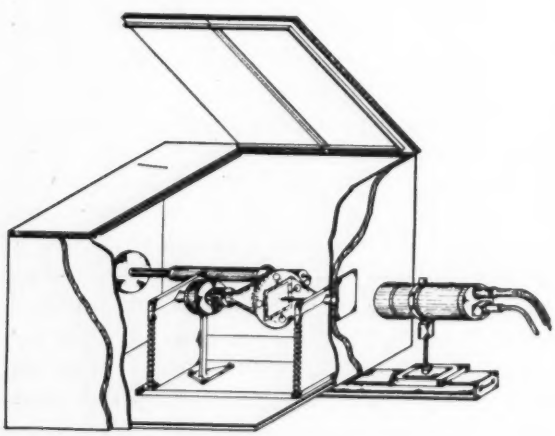

Fig. 1. Diagram of original model of scanning roentgen tube mounted in lead-lined box and faced by the housing containing the calcium fluoride screen and the phototube.

results to date have been obtained is shown diagrammatically in Figure 1. This diagram shows the tube mounted in its lead housing with the pinhole in the right-hand side faced by the housing containing the calcium fluoride detector screen and the phototube. In this tube* the target is of stretched tantalum foil with the electron gun situated at the left hand of the tube and the focusing and sweep coils surrounding the neck in which the electron gun lies. The electrons impinge on the rear surface of the tantalum target and the roentgen rays that they produce pass through the target in order to reach the pinhole. Due to the small dissipation of the thin tantalum foil, this tube must be operated at low power input—approximately 60 kv. and 3 ma. Furthermore, the number of roentgen-ray quanta passing through the pinhole is reduced by absorption in the tantalum foil. Since the output is small, Moon scans over a small area in order to conserve the number of quanta available. The results so far have therefore been limited to small specimens.

The problem of designing a tube to operate at high voltage and large beam current was first taken to the Machlett Company. Approximately a year ago their tube designers suggested as a possible commercial design the tube shown in Figure 2. In this tube, electrons are emitted by the annular filament and are driven upward through the aperture in the beryllium diaphragm. They then enter a cone-shaped space where they are focused into a sharply defined beam by the focusing coils and swept over the surface of the target by the deflecting coils. The target is of tungsten backed by a water-cooled copper block. The surface of the target is spherically shaped so that it will conform to the location of the focal point of the electron beam as it is swept across the target. The useful beam of roentgen rays is emitted in the backward direction, passing up through the beryllium diaphragm and the pinhole in the lead diaphragm. In this way the difficulties of correcting keystone deformity are avoided. In this tube the cathode would probably be operated at ground potential in order to facilitate mounting on the roentgenoscope and to

* Two tubes of this design were built for Professor Moon by The Rauland Corporation.

simplify the design of the focusing coils and sweep coils. It was recognized that the design and construction of an electron gun would be one of the major problems in the building of this tube and when the Pierce gun became available from the Bell Laboratories it was decided to turn to it instead—at least for the time being.

Figure 3 shows a tube which Moon has designed around the Pierce gun. At the top of the diagram the Pierce gun may be

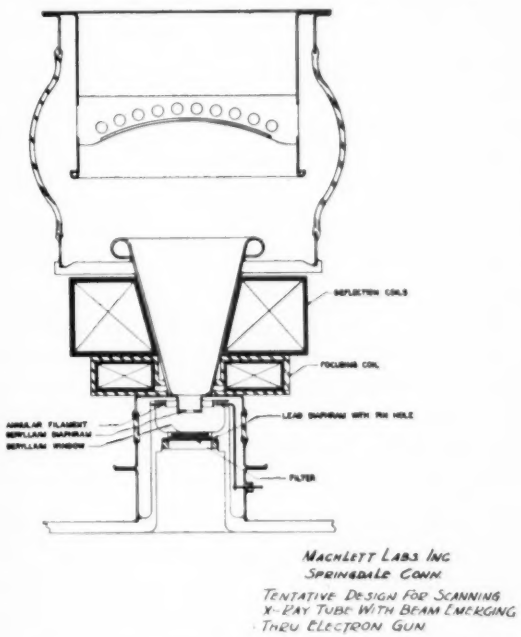

Fig. 2. Tentative design for scanning roentgen tube suggested by the Machlett Company.

seen. Electrons originating here are focused into a narrow beam which passes through the secondary anode and enters a field-free space in a long, tubular, inner glass envelope. The inner surface of the envelope, target and secondary anode are all at the same positive potential, which is the maximum target voltage. Electrons are focused as they pass through the focusing coils and are swept over the surface of the target by the sweep coils. The water-cooled tungsten target has a plain surface in this tube since the focal length is long and there is not much defocusing with deflection over the surface of the target. The useful roentgen-ray beam is emitted at an angle to the electron beam, passing out through a thin foil in the anode cone and through a beryllium window in the outer envelope. Unlike the Machlett tube, the

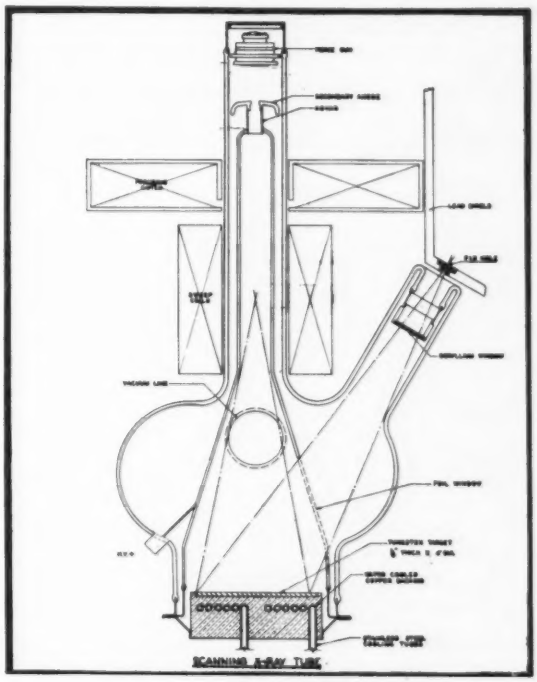

Fig. 3. Diagram of scanning roentgen tube now under construction.

images produced by this one would suffer rather pronounced keystone deformity, except for the fact that electronic engineers have well tried and thoroughly successful means of compensating for this by means of special scanning circuits. Eventually it may prove profitable to angle the target of the tube so that correction of keystone deformity will be geometric rather than electronic.

Details of the Pierce gun used in this tube are shown schematically in Figure 4. Near the top of this diagram is a cathode button which is heated by electron bombardment from the heater coil operated at a potential 2,000 volts negative with respect to the cathode. The button, made of tungsten and with its curved lower surface coated with thorium oxide, is mounted in a collar having sloping sides of a carefully determined angle. The shape of these sur-

faces is such that the emitted electrons are gathered into a bundle just large enough to pass through the circular opening in the first anode. A 5,000 volt difference of potential is maintained between the cathode and the first anode, and the principal voltage—95 to 120 kilovolts—is maintained between the first and second anodes. As a result of

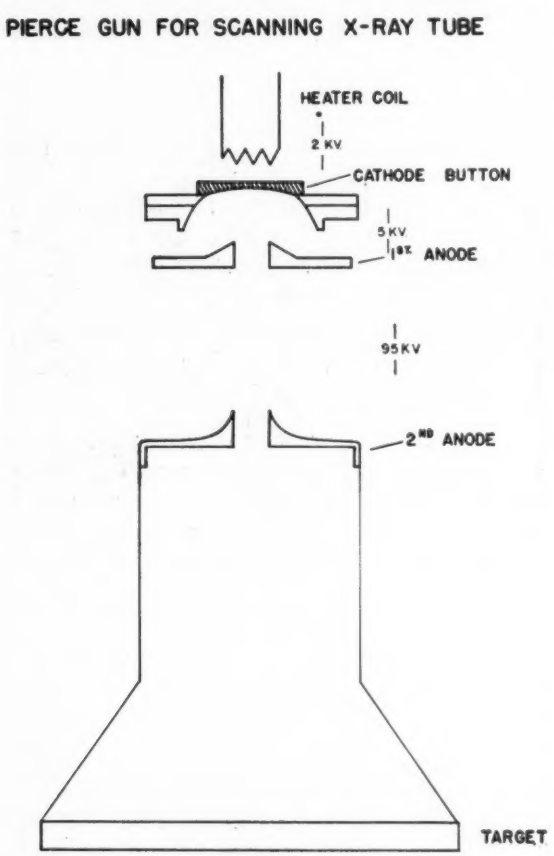

Fig. 4

these potentials and the shape of the electrodes, a parallel beam of electrons traveling at a high rate of speed flows through the opening in the first anode, on through the opening in the second anode, and into the tubular field-free space lying between the second anode and the target. Due to the mutual repulsion of electrons, the beam in the field-free space diverges into a cone that has its geometrical apex at a point somewhat behind the target button, which point may be designated as the virtual focus of the electron beam. When the diverging stream of electrons* reaches the optical center of the focusing coils, which act as magnetic lenses, divergence ceases and convergence begins, and by suitable design and shaping of the focusing coils the focus of these converging electrons can be brought to fall exactly at the surface of the target. It is important that the base of the divergent cone (which is also the base of the convergent cone) be allowed to reach considerable proportions so that the angle of convergence on the target will be rather large. This is necessary if a large number of electrons is to be concentrated on a fine focal spot. In this particular system the base of the cone will be approximately 0.5 cm. and the focal spot surely no larger than 100 microns, possibly as small as 25 microns. The nominal rating of the first gun received from Dr. Pierce's laboratory is 40 ma. but there is reason to believe that it can be made to operate satisfactorily at 100 ma.—at least for experimental work.

There is no reason to assume that this will be the final form of the scanning roentgen-ray tube and, as a matter of fact, this particular one will not even be sealed off but will be run on a vacuum pump. But it is a great advance over the original modified television tube in which the current and voltage settings had to be low and the roentgen rays generated by the electron beam had to penetrate the target on their path to the pinhole.

Even before this tube had been delivered by the manufacturer, Moon began to sketch other tubes that he hopes will be better, including one that is folded on itself in order to facilitate clinical application. Meanwhile, plenty of experimental work awaits operation with the present model—work that should carry the project into areas which until now could be exploited only by extrapolation.

DETECTOR SCREENS

At first it was thought that the detector

* A parallel beam or one with uniform divergence entering the magnetic lens is necessary for the production of a fine focal spot.

screen would consist of a mosaic made up of carefully fitted little blocks of natural calcium fluoride crystal because that material experimentally proved to be better than others, such as barium lead sulfate, conventional roentgen-ray roentgenoscopic and intensifying screens, calcium tungstate, anthracene, thallium activated sodium iodide, etc. Fortunately, however, American chemical companies now are able to grow large synthetic single crystals of calcium fluoride that are water clear and flawless. At the moment, Moon has a circular crystal of calcium fluoride 2 cm. thick and 10 cm. in diameter, and the manufacturer expects to be able to supply presently a circular block, 15 cm. in diameter, which will allow for the desired 4 by 4 inch square scanning surface.

PHOTOTUBES

If it had been necessary to continue to work with the commercially available phototubes 1P21 or 1P28, lenses would have been required to gather the light from the detector screen and concentrate it on the cathodes of one or more of those tubes, but during the last year an imported end-window photomultiplier tube has become available and it does not require a lens system.* This tube is equipped with eleven dynodes of the venetian blind, unfocused type, has a photocathode surface 1 inch in diameter and an envelope of ultraviolet transmitting glass.

The detector screen is polished except for a 2.5 cm. disc on the anterior surface which is slightly roughened with an emery cloth. The end window of the phototube is mounted with its photocathode close to this roughened spot. By virtue of internal reflection the light generated in the crystal by the roentgen-ray quanta of the scanning beam is distributed rather uniformly throughout it, being able to escape only through the roughened disc on the anterior surface. There is reason to hope that it will not be necessary to refrigerate either the phototube or the screen.

* Electrical and Musical Industries, Ltd., VX5032.

VIEWING SCREENS

A 10-inch kinescope of conventional television type is normally employed for viewing the roentgenoscopic image. When the parts being examined are approximately stationary or are moving rather slowly, the image can be improved by storing the incoming signal for approximately six frames, thus causing the image on the kinescope to change only five times a second instead of the conventional thirty times per second. One way to do this is to employ a second tube either independently or simultaneously and to have its screen coated with a slow phosphor (for example, radar tube P7). Even better is to feed the signal first to a memory tube before it modulates the beam of the kinescope. Unlike the slow phosphor tube whose integrating time is fixed, the memory tube can have its storage time adjusted, at will, over an almost infinite range.

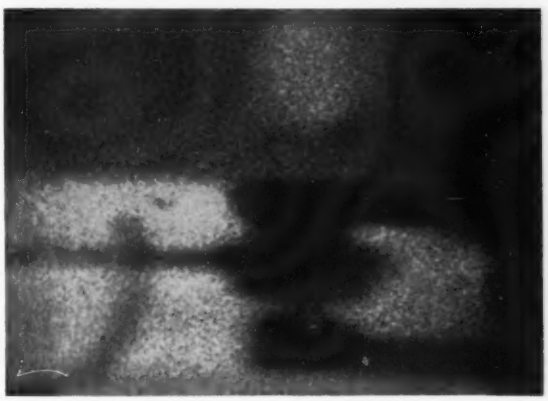

Fig. 5. Photograph of the kinescope screen showing an enlarged reproduction of a portion of a microswitch.

Eventually Moon hopes to develop a tube combining in one envelope a memory tube and a kinescope. In such an instrument the signal would be received continuously but delivered to the viewing screen intermittently at a rate that is under the control of the observer. This would have two advantages. In the first place, graininess incident to statistical fluctuation would be reduced and, in the second place, since the image would be received by the

eye as a complete frame rather than line by line the phenomenon known as "flicker" would be reduced.

RESULTS

The results to date have been obtained using the tube shown in Figure 1. Since the output of this tube is many times smaller than that of the proposed tube, Moon scans over a small area in order to conserve the number of quanta per unit time in each picture element. The low output of roentgen-ray quanta in the present system makes for a poorer image and the image undoubtedly will improve as the output increases. On the other hand, all else being equal, enlarging the screen and examining thicker objects will make for a poorer image. It remains to be seen what the algebraic sum of these will be. Figure 5 is a picture of the kinescope screen showing an enlarged view of the contact area of a microswitch. The approximate area of the test object included in the picture is 15 by 21 mm. Good contrast is seen between 1.7 cm. of bakelite across the top of the picture and 0.3 cm. of bakelite across the bottom. Also, the resolution of the 0.025 cm. spring supporting the movable contact is good.

The difference between the quality of the picture of a stationary object on the slow and the fast screens is striking to the eye. The fast screen appears like a snowstorm with regions of larger and smaller density of light flashes, while the slow screen approaches a much more uniform distribution of light over regions of constant roentgen-ray transmission. But for rapidly moving objects the fast screen follows the object and the slow screen produces a blurred image.

The detail that may be seen on the fast screen is quite surprising, considering the large intervals in spacing and time of successive flashes of light. The results seem to indicate that the eye can integrate information over periods of time much longer than the commonly accepted integrating time.

The appearance of the fast screen also gives one the impression that only a small number of the picture elements in one scanning cycle show any light. Since Moon[3] calculates about 20 quanta per picture element for the high intensity tube operating with 25 cm. of wet tissue between the tube and the detector screen, and the number to be expected for his present machine is of the same order of magnitude, one is faced with the conclusion that the conversion of roentgen-ray quanta to light on the viewing screen is very inefficient. Moon would be the last to deny that great improvements could be made in this direction.

CONCLUSION

Moon has demonstrated on a small scale a system of roentgenoscopic image amplification and intensification which appears promising. Much work remains to be done in improving the output of scanning roentgen-ray tubes, the efficiency of detector apparatus, the operation of electronic circuits and the method of presenting the picture on viewing screens. The results are too meager for a quantitative comparison with other systems but appear certain of some measure of success.

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REFERENCES

1. Moon, R. J. Amplification of fluoroscopic image by means of thick dense clear crystalline detector screen and scanning roentgen-ray tube. Am. J. Roentgenol. & Rad. Therapy, 1948, *59*, 886–888.
2. Moon, R. J. Discussion of Symposium on intensification of roentgenoscopic screen. Am. J. Roentgenol. & Rad. Therapy, 1949, *62*, 637–643.
3. Moon, R. J. Amplifying and intensifying fluoroscopic image by means of scanning x-ray tube. *Science*, 1950, *112*, 389–395.

DISCUSSION

Dr. Russell H. Morgan, Baltimore, Maryland. The work which Dr. Hodges and Dr. Skaggs have described this morning constitutes a notable contribution to the field of screen intensification. It is work of this sort which is bringing closer the day when we shall all be able to enjoy the advantages of brighter fluoroscopic screens.

Dr. Hodges' remarks hardly need further comment from me. Therefore, I should like to take this opportunity to review very briefly the work that has been done in two other laboratories in this field. Early in 1943 the Westinghouse Electric Corporation, under the direction of Dr. J. W. Coltman, began extensive studies of the problems of brightening the fluoroscopic screen. Since that time, the work has proceeded without interruption, and it is now possible to report that Dr. Coltman and his colleagues at Westinghouse have developed a screen intensifier having a gain in brightness of some 150 times over that of the screens we use today.

One of these units has recently been installed in the Department of Radiology at the Johns Hopkins Hospital. Indeed, on September 19, 1950, it went into clinical use in one of our regular fluoroscopic rooms. As far as I know, this represents the first clinical application of a screen intensifier. I believe that it is an occasion which marks a notable milestone in the history of diagnostic radiology.

In a moment or two, I should like to show you a slide which will demonstrate the performance of the Westinghouse unit. Before that, I should like to report, however, on work which we have been doing independently in our own laboratory since 1947. In the early stages of our research, we concerned ourselves principally with a study of the fundamental physical and physiological processes of vision. From this study we were able to estimate not only the ultimate benefits that might be achieved by increasing the brightness of the roentgenoscopic screen but also to determine which screen intensification systems were most likely to yield these benefits. It appeared to us that two systems were particularly attractive for intensive investigation. The first was one which made use of an electron image tube for the intensification process. Such a system is the one which has been pursued by Dr. Coltman and which for convenience may be called the Coltman-Westinghouse system. The second was a modified television arrangement using a specially designed image orthicon of extremely high sensitivity and a Schmidt optical system of high speed and resolution. It is the latter system on which we have been working for some time. Indeed a screen intensifier of this type has just been completed and will undergo its first clinical trial next week. For purposes of designation we are calling screen intensification systems of this type the Johns Hopkins system.

The following are two slides which show the approximate brightness and clarity of the screen intensifier designed by Dr. Coltman and the screen intensifier which we have completed. These slides, I believe you will agree, indicate that both instruments show great promise. In fact, it appears that the long sought-after day when fluoroscopic screens that are 500 to 1,000 times brighter than those of today will soon be with us. The brightnesses of the images which you see projected before you are approximately the same as those seen on the screens of the intensifiers. Certainly these instruments will eliminate the need for dark adaptation on the part of the roentgenologist. Quantitative measurements also indicate that the clarity of the brightened images is greater than two times that seen on standard roentgenoscopic screens.

Dr. Robert J. Moon, Chicago, Illinois. The report of Dr. Morgan has certainly been very stimulating as to the results he has achieved with the Coltman system, and also with both the Coltman system and his own system.

There are many stones left unturned in this field, as Dr. Morgan indicated. In connection with the particular system which we have, at the present time it is large and awkward, as you no doubt realize from what Dr. Hodges said. The Coltman system is certainly very much more portable.

I would like to emphasize one point in connection with the particular scanning system, and that is the fact that the image is not assembled until we get to the final picture tube on the kinescope. This means that we can use as thick a detector as is needed to absorb—in fact, to completely absorb—all the roentgen rays that pass through the object and fall upon the detector screen, which in turn makes it feasible to gather all of the information that can be rendered by those roentgen-ray quanta penetrating the object whose structure is wanted. This is quite apparent in some of our experimental work; if we take the ordinary Patterson B screen and place it between the object and the screen which we use, there is only a small diminution of intensity—some 10 per cent.

This indicates a further field which might be of interest to roentgenologists, namely, that of higher energies, energies on the order of 200,000 or 300,000 volts, when the better penetration may be utilized by having a suitable detector screen. As to where we will go from here, only time will tell.

ROENTGENOGRAPHIC FINDINGS IN CONGENITAL TRICUSPID ATRESIA WITH HYPOPLASIA OF THE RIGHT VENTRICLE

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DUE to the specialized surgical treatment now available, the roentgen recognition of abnormalities of the heart producing cyanosis is becoming increasingly important.

Patients with tricuspid atresia and hypoplasia of the right ventricle have been operated upon under the working diagnosis of "variants of tetralogy of Fallot"[3,5,15] and, conversely, some of these congenital abnormalities of the heart which might have benefited from surgery failed to receive attention due to lack of recognition of their characteristic features.[5,12]

In firm agreement with Shapiro,[13] and Peck and Wilson[11] regarding the value of conventional methods of roentgenography in congenital heart disease, we have felt a need for reviewing and redefining the roentgen criteria of tricuspid atresia with hypoplasia of the right ventricle in the light of recent knowledge.

Findings on 11 patients with tricuspid atresia and hypoplasia of the right ventricle will be reviewed. On 5 of these complete postmortem studies are available; in addition, 3 were operated upon (incomplete confirmation of the diagnosis). In 1 additional patient the diagnosis was supported by angiocardiography; in the remaining 2 cases the diagnosis rests upon clinical, electrocardiographic and roentgen evidence.

BASIC MALFORMATION

In tricuspid atresia the tricuspid valve and the right ventricle are not a truly functional part of the heart; they may be markedly hypoplastic or completely absent. As an invariable corollary there is an associated malformation of the outflow tract of the right ventricle; namely, the pulmonary orifice and main pulmonary vessel are either stenotic, hypoplastic or aplastic.

In congenital tricuspid stenosis, in contrast to the atresia, some blood follows the normal course through the right ventricle and pulmonary artery to the pulmonic vascular bed. Although differing only in degree anatomically, the fact that the right ventricle participates in the maintenance of the pulmonic circulation makes the tricuspid stenoses distinct from the atresias. They differ in the course of the blood, physiologically, and in roentgen appearance, particularly in the pulmonary vascular bed. It has been our experience that this group of tricuspid stenoses is almost invariably associated with partial transposition of the great vessels. This group of patients is not included among the 11 atresias in this presentation.

If tricuspid atresia is to be compatible with life, other anomalies must exist to allow the flow of blood from the right auricle to the left side of the heart and to the pulmonic circulation. The persistence of normal fetal channels, namely a patent foramen ovale with patency of the ductus arteriosus, permits this blood flow and it is

the most common association of anomalies (Fig. 1*B*).

An associated interventricular septal defect may increase the flow of blood into the pulmonary circulation, even though the right ventricle may be practically non-functioning, acting primarily as a passive transit chamber (Fig. 1*C*).

The combination of these associated defects and their effect on pulmonary blood flow is illustrated in Figure 1. Note that in Figure 1*C* there is opportunity for increased pulmonary blood flow through the interventricular septal defect, a combination favoring a somewhat longer life expectancy.

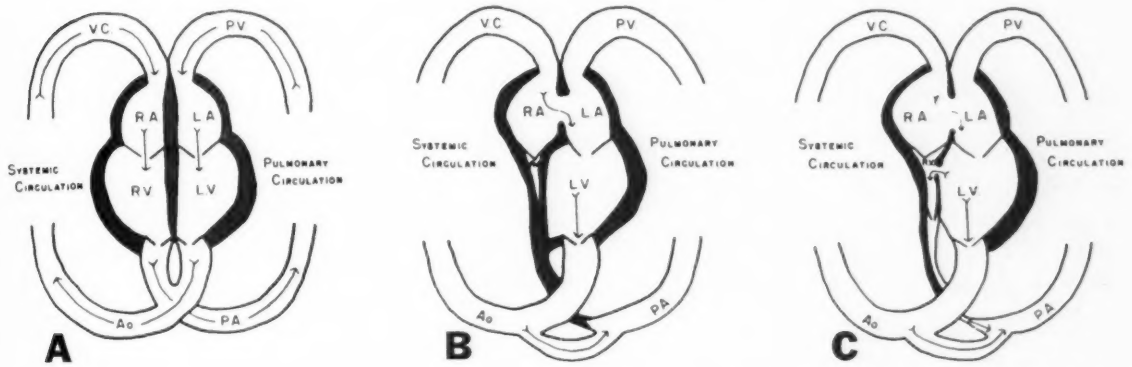

Fig. 1. The common malformations seen in tricuspid atresia and hypoplasia of the right ventricle. In all cases the blood pursues an abnormal course.

(*A*) Normal extrauterine circulation.

(*B*) Tricuspid atresia with hypoplasia of the right ventricle and associated (1) auricular septal defect, (2) patent ductus arteriosus. In this case the right ventricle may be completely absent or minute, not functionally a part of the heart.

(*C*) Tricuspid atresia with hypoplasia of right ventricle and associated (1) auricular septal defect, (2) patent ductus arteriosus, (3) ventricular septal defect. The interventricular septal defect or the outflow tract of the right ventricle may be so minute that this pathway is non-functional and the right ventricle will then be filled with an old blood clot. The interventricular septal defect, however, may permit varying amounts of blood to be pumped from the left ventricle through the septal defect and the rudimentary right ventricle into the pulmonary circulation, thus improving the lung blood flow, but the right ventricle remains small and non-functioning.

INCIDENCE OF TRICUSPID ATRESIA

The relative incidence of congenital hearts varies markedly with age. This is the result of an average difference in the natural life expectancy of each type or combination of congenital defects. The older the patient, the less the number of likely diagnostic possibilities for any given set of heart findings. The total number of reported patients with tricuspid atresia and hypoplasia of the right ventricle is 61. Many are isolated reports. In many it is impossible to evaluate a possible associated transposition of the great vessels from the data presented. In any case it is now known that the absolute incidence is much higher than this figure would indicate.

Table 1 is a composite made up of reported series of congenital hearts from the medical literature.

Abbott,[1] in the study of 1,000 patients with miscellaneous congenital hearts found an estimated 376 of cyanotic type. Eek[6] had 114 cases of cyanotic congenital hearts in a well studied clinical series including angiocardiography, and Gibson and Clifton[7] report postmortem analyses of 105 unselected congenital hearts, of which 25 had a history of cyanosis.

These figures reveal that tricuspid atresias make up from 2 to 4 per cent of cyanotic congenital heart disease. The tetralogy of Fallot is certainly the predominant

cause of cardiac cyanosis if all age groups are considered with an over-all incidence of 23 to 50 per cent. It should be added that the relative incidence of tetralogy of Fallot increases with age. In examining patients with congenital cardiac cyanosis the radiologist may encounter one with tricuspid atresia to every 6 to 30 patients with tetralogy of Fallot.

pulmonary circulation are the greatest factors in the survival during early life, as well as in the response to operation. If the patient lives two or more years one may usually assume that the auricular septal defect is not diminutive and that (a) the ductus arteriosus remained patent, or (b) that sufficient collateral circulation has developed via the bronchial arteries, or (c) that

TABLE I

	Abbott	Eek	Gibson and Clifton
Total patients reported	1,000		105
Number with cyanotic heart disease	376 (estimated)	114	25
Tetralogies of Fallot	85, or 23%	61, or 53%	8, or 32%
Eisenmenger complex	12, or 3.2%	19, or 17%	
Tricuspid atresias	12, or 3.2%	2, or 1.7%	1, or 4%
Relative incidence of tricuspid atresias to tetralogies of Fallot	1 to 6	1 to 30	1 to 8

CLINICAL ASPECTS

Many medical writers have emphasized that the clinical appearance, findings and course of the child with tricuspid atresia and hypoplasia of the right ventricle may be, and usually is, indistinguishable from that of a child with tetralogy of Fallot. This fact increases the importance of careful roentgen and electrocardiographic studies.

Cyanosis at or shortly after birth usually brings these patients to the attention of the physician early. In 9 of our 11 patients, the diagnosis of tricuspid atresia was made within the first year of life. Murmurs are not constant; in fact, may be absent. The liver is usually palpable, but in none of our patients was pulsation of the liver recorded. Many of these patients die in infancy. Six of our 11 patients died within the first year and a half of life and an additional patient died at the age of four years two months, a mortality of 64 per cent in this series.

In this malformation the amount of blood passing through the heart, which may be limited by the size of the auricular septal defect, and the blood passing through the some blood is escaping through an associated interventricular septal defect and through the rudimentary right ventricle and pulmonary artery to reach the pulmonary circulation, as shown in Figure 1*C*.

The electrocardiogram is of invaluable aid in the detection of unsuspected cases as well as in the differential diagnosis of tricuspid atresia. In the past, left axis deviation was considered the characteristic finding in this disease. Recent studies[9] in this hospital have shown that tricuspid atresia does not invariably give rise to this electrocardiographic abnormality. While left axis deviation, especially in the young ages, is strong evidence for this congenital anomaly, its absence does not rule out this diagnosis. What is more important is the demonstration of abnormal degrees of left ventricular preponderance, particularly in the newborn, in which relative right ventricular preponderance is the normal finding. In the older children left ventricular hypertrophy is often revealed by more definite electrocardiographic changes. These observations stress the need for detailed electrocardiographic studies with unipolar multiple chest leads and limb leads in order to

demonstrate the above mentioned findings. It should also be kept in mind that occasionally a single ventricle heart, transposition of the vessels with pulmonic stenosis, and auricular septal defect with pulmonic stenosis[17] may present electrocardiographic findings of abnormal left ventricular preponderance.

ROENTGEN APPEARANCE OF THE HEART

Size. Almost all infants begin life with a heart of approximately the same size. This is true in the normal and in the congenitally defective hearts. Primary myocardial disease is the dominant exception. Moreover, in the normal neonatal heart the right and left ventricles are usually of equal prominence in the roentgenogram and the right and left ventricular myocardium of equal thickness.

At, or shortly after birth, the size of the heart with tricuspid atresia, tetralogy of Fallot and truncus arteriosus is usually normal. As the child grows older the heart in those with tricuspid atresia and tetralogy of Fallot usually remains within normal limits by conventional roentgenographic measurements (in fact, may fall below normal) while enlargement by transverse diameter in the posteroanterior view is usually seen in transpositions of the great vessels and occasionally in truncus arteriosus.

Configuration of the Heart. A "characteristic X-ray appearance of tricuspid atresia" has been described by Taussig[16] and others. The practicing radiologist finds with disappointment that this characteristic appearance is not generally applicable, although perpetuated in medical writing.[3,5,11,13,15] Only 2 of our 11 patients presented this appearance.

The heritage of roentgenologic terminology which defines heart appearances as "right ventricular enlargement," "left ventricular enlargement," "prominence of pulmonary artery," or worse "prominent pulmonary conus," adds confusion to a perplexing problem due to the inherent weakness of this descriptive process. It is based upon fixed criteria of chamber enlargement carried over from basic studies on acquired heart desease, all of which are built upon the premise that the position, size and relation of the chambers was initially that of an adult normal heart. Criteria for chamber enlargement such as "right ventricle—bulging anteriorly and toward right in L.A.O."[16] or "left ventricle—spine partially crossed by heart in L.A.O. position"[11] are good if the chamber enlargement is superimposed upon an essentially normal heart as in acquired cor pulmonale or hypertension. They fail to apply in congenital heart disease where the heart may be either grossly abnormal by development or fail to develop normally in extrauterine life due to abnormal course of blood flow.

In adapting itself to the demands of extrauterine life, instead of developing preponderance of the left ventricle to meet the increased pressure of the systemic circulation as normally occurs, congenital defects may exist which so alter the flow of blood or pressure that one chamber may remain underdeveloped or infantile for life.

Under these circumstances the usually accepted criteria of right and left enlargement are entirely useless. One may at times be dealing with only one ventricle, as in some of the trilocular hearts or pseudotrilocular hearts of tricuspid atresia. In tricuspid atresia and tetralogy of Fallot the substance of the heart is predominantly one ventricle—left in the tricuspid atresia, right in the tetralogy. In neither case is this enlarged ventricle superimposed upon a normal heart or even a normal opposite ventricle. In the tricuspid atresias the right ventricle is congenitally rudimentary or is completely absent, while in the tetralogy of Fallot the left ventricle may remain essentially infantile in development as a result of the diminished load. The appearance of the heart may be identical. It is important that the radiologist recognize that these hearts may not be specifically distinctive for either right- or left-sided enlargement. In this case there are no uni-

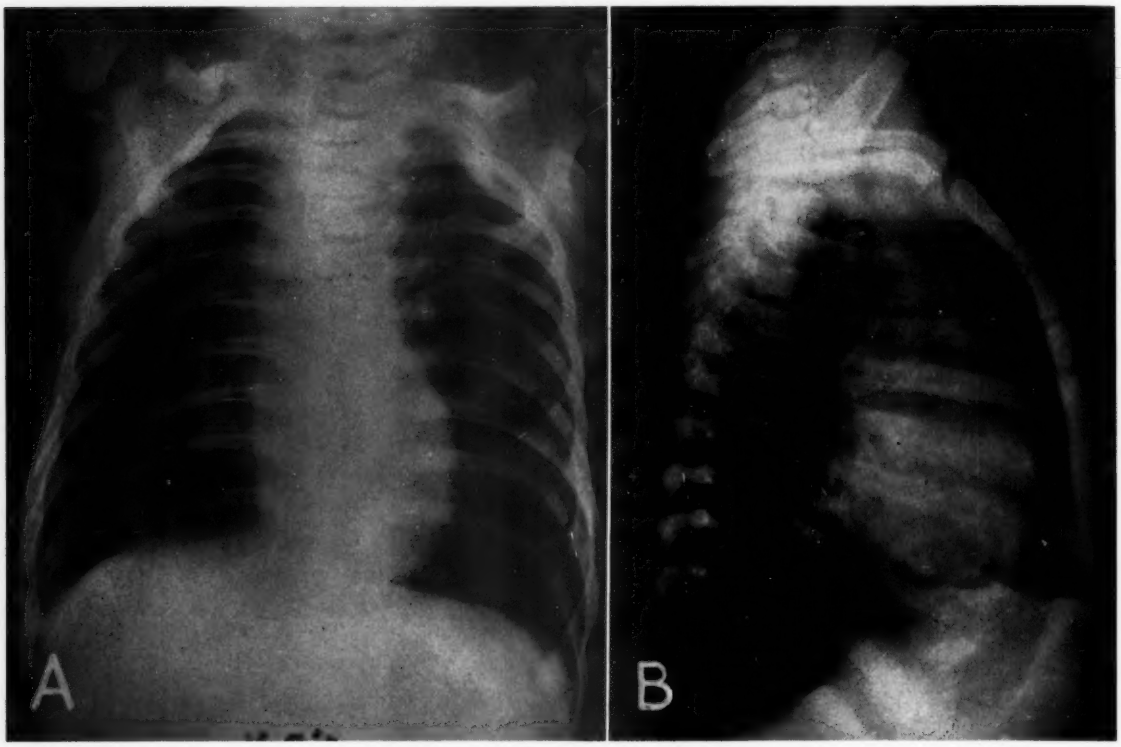

FIG. 2. (*A*) Posteroanterior and (*B*) right lateral roentgenogram of heart with characteristic configuration. Roentgen appearance: Small heart, diminished prominence of right border of heart, narrowing of the "waist" on the left where the pulmonary artery normally lies, and diminished pulmonary vascular markings.

One month old patient, intermittent cyanosis since birth, with no cardiac murmur; hemoglobin 16.5 gm. and erythrocyte count 6.25 million, with a normal size liver and no pulsation. Died age of five months of cardiac failure, and at postmortem examination was found to have: Tricuspid atresia, "vestigial" right ventricle, two auricular septal defects (one measuring 3 times, the other 2 times the diameter of the mitral valve), patent ductus arteriosus measuring the diameter of the mitral orifice with no interventricular septal defect and a left aortic arch.

versally applicable roentgen criteria of left and right ventricular enlargement. He must avail himself of the additional information afforded by the electrocardiogram, which will definitely identify the dominant ventricle and establish the diagnosis.

Our children with tricuspid atresia fell into three general categories based upon the roentgen appearance of the heart.

1. "Characteristic" or specific configuration ..... 2 patients
2. "Coeur en sabot" configuration 5 patients
3. "Coeur en sabot" with dextrocardia appearance (resembling a tetralogy of Fallot with dextrocardia) ..... 4 patients

These are discussed in detail:

1. *"Characteristic" or specific appearance of tricuspid atresia.*

The "characteristic change in the contour of the heart" commonly described as indicative of absence or hypoplasia of the right ventricle was found in 2 of our cases. It is as specific an appearance as can be found in cardiac roentgenology and if associated with diminished prominence of the pulmonary vascular markings would be graded by Sosman[14] as an "absolute certain" or "indubitable" roentgen appearance. It is characterized by:

(a) Diminished convexity, or actual concavity of the lower right border of the cardiac silhouette in the posteroanterior projection and of the anterior border in the left ante-

rior oblique projection, the direct result of absence or hypoplasia of the right ventricle.

(b) Narrowing of the waist of the heart, evidenced by concavity of the waist on the left in the posteroanterior projection, where the pulmonary artery normally lies, direct evidence of the absence or hypoplasia of the main pulmonary artery. This is further supported by increased radiolucency of the pulmonary window.

(c) The left border of the heart may be prominent in the posteroanterior projection and fail to clear the spine in the left anterior oblique position, evidence of the left ventricular enlargement. Due to the expansion of the left ventricle in the absence of a normal right ventricle it assumes an unusual shape and usually presents an appearance of a blunt and false apex high above the diaphragm, simulating at times the elevation of the apex seen in right ventricular enlargement.

(d) Diminished prominence of the peripheral pulmonary vascular markings, direct evidence of reduced pulmonary blood flow.

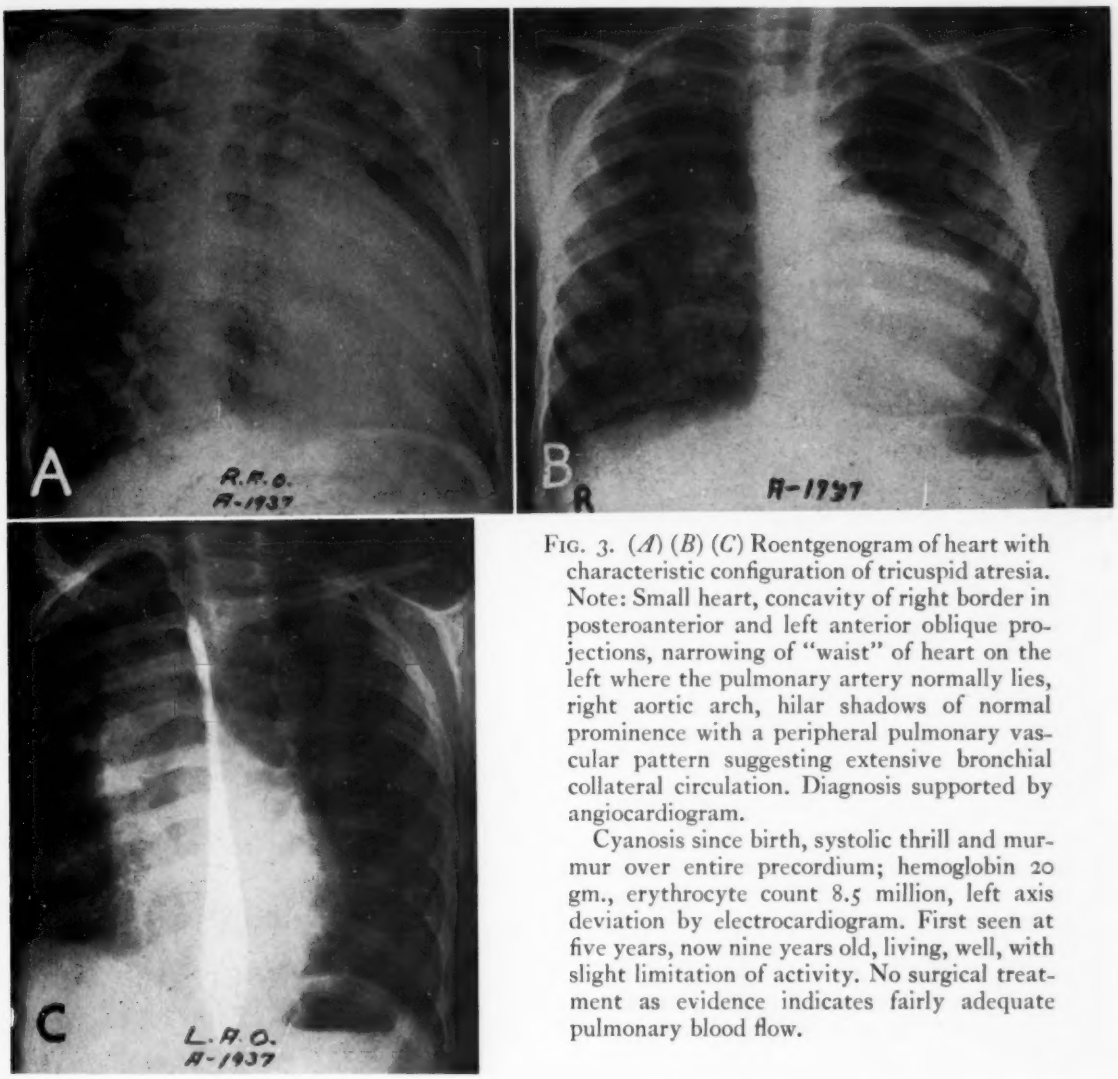

Fig. 3. (*A*) (*B*) (*C*) Roentgenogram of heart with characteristic configuration of tricuspid atresia. Note: Small heart, concavity of right border in posteroanterior and left anterior oblique projections, narrowing of "waist" of heart on the left where the pulmonary artery normally lies, right aortic arch, hilar shadows of normal prominence with a peripheral pulmonary vascular pattern suggesting extensive bronchial collateral circulation. Diagnosis supported by angiocardiogram.

Cyanosis since birth, systolic thrill and murmur over entire precordium; hemoglobin 20 gm., erythrocyte count 8.5 million, left axis deviation by electrocardiogram. First seen at five years, now nine years old, living, well, with slight limitation of activity. No surgical treatment as evidence indicates fairly adequate pulmonary blood flow.

Only 2 of our patients presented this "characteristic" configuration. A right aortic arch was found in one; a normally placed left aortic arch in the other. Figures 2 and 3 illustrate the hearts in these patients.

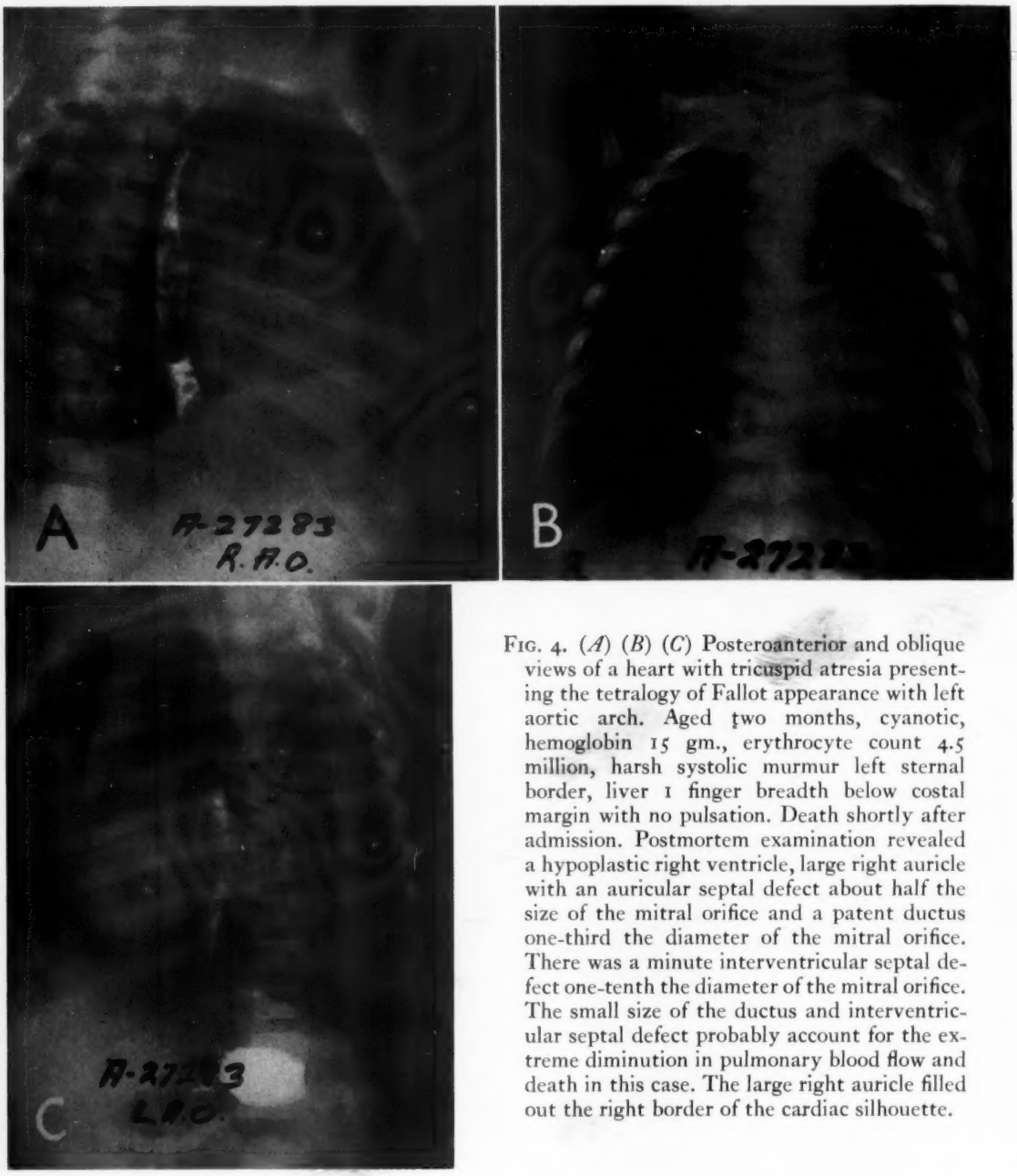

FIG. 4. (*A*) (*B*) (*C*) Posteroanterior and oblique views of a heart with tricuspid atresia presenting the tetralogy of Fallot appearance with left aortic arch. Aged two months, cyanotic, hemoglobin 15 gm., erythrocyte count 4.5 million, harsh systolic murmur left sternal border, liver 1 finger breadth below costal margin with no pulsation. Death shortly after admission. Postmortem examination revealed a hypoplastic right ventricle, large right auricle with an auricular septal defect about half the size of the mitral orifice and a patent ductus one-third the diameter of the mitral orifice. There was a minute interventricular septal defect one-tenth the diameter of the mitral orifice. The small size of the ductus and interventricular septal defect probably account for the extreme diminution in pulmonary blood flow and death in this case. The large right auricle filled out the right border of the cardiac silhouette.

2. *"Coeur en sabot" appearance of tricuspid atresia.*

Five of our cases reveal a roentgen configuration almost identical, if not completely so, with that in the tetralogy of Fallot. In contrast to the first group, the radiologist can only extend his examination to Sosman's[14] "third degree of certainty," "unable to differentiate between" tetralogy of Fallot or tricuspid atresia. Any information available to him by direct interrogation of the patient, consultation, etc., is of no definite differential value. It behooves him to follow the advice of wisdom in this group and "withhold or qualify his final opinion, or indicate what test is necessary to confirm his suspicions." An electrocardiogram will give more accurate information

as to whether this practically "univentricular" heart is right ventricle or left ventricle. One of these 5 cases presented a right aortic arch, an incidence of 20 per cent, similar to the incidence in tetralogy of Fallot. A representative case is shown in

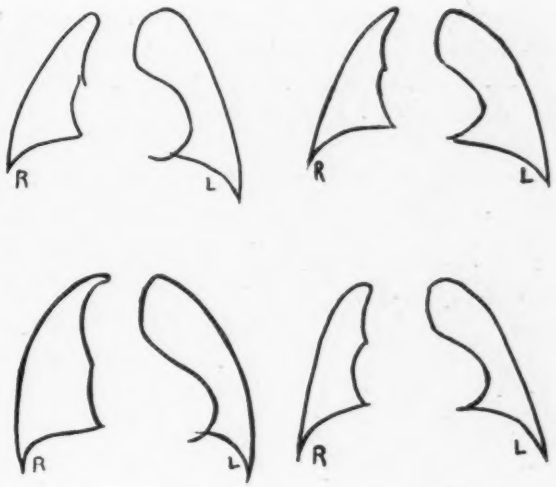

Fig. 5. Tracings of roentgenograms of 4 of the 5 tricuspid atresias presenting a tetralogy of Fallot appearance. Note the lack of evidence of enlargement by transverse diameter in the postero-anterior view, the elevated "apex" usually considered evidence of right ventricular enlargement and the narrowed cardiac waist on the left where the pulmonary artery normally lies. All show diminution in the pulmonary vascular markings.

Table II

	D. R.	P. McN.	H. C.	J. A.
Age: first visit	7 mo.	2 mo.	3 mo.	4 yr.
Age: death			3 mo.	4 yr. 2 mo.
Age at onset of cyanosis	Birth	Birth	Birth	1 yr.
Cardiac murmurs	Gr. 3 systolic entire precordium	?	Systolic left of sternum	?
Liver: fingers' breadth costal margin	1–2	1	1	2
Liver: pulsation	0	0	0	0
Activity	Limited	Normal	Normal	Limited
Percentile development: height	25	10	Less 3	
Percentile development: weight	25	3	Less 3	
Blood: erythrocytes in millions	7		5.7	6.5
Blood: hemoglobin in grams	26	17.8	18	23
Position of aortic arch	Left	Left	Left	Left
Surgery	Age 12 yr. Pott's procedure with graft		0	Age 4 yr. 4–5 mm. Pott's procedure
Response	Clearing of cyanosis			3 wk. improvement, then cardiac failure
Follow-up	Age 13 yr. living and well	Age 3 yr. living and well	Age 3 mo. death from aspr. pneum.	Cardiac failure
Findings at postmortem examination: aortic arch			lt.	
Findings at postmortem examination: pulmonary artery			0.1 cm.	
Findings at postmortem examination: rt. auricle			dia. 2 cusps	
Findings at postmortem examination: rt. ventricle			1 cm. gt. dia.	
Findings at postmortem examination: lt. auricle				
Findings at postmortem examination: lt. ventricle				
Findings at postmortem examination: A.S.D./M.*			1.2 cm./4.5 cm.*	
Findings at postmortem examination: V.S.D./M.**			0**	
Findings at postmortem examination: P.D.A./M.***			0.2 cm./4.5 cm.***	

* Size of auricular septal defect relative to mitral valve.
** Size of ventricular septal defect relative to mitral valve.
*** Size of patent ductus septal defect relative to mitral valve.

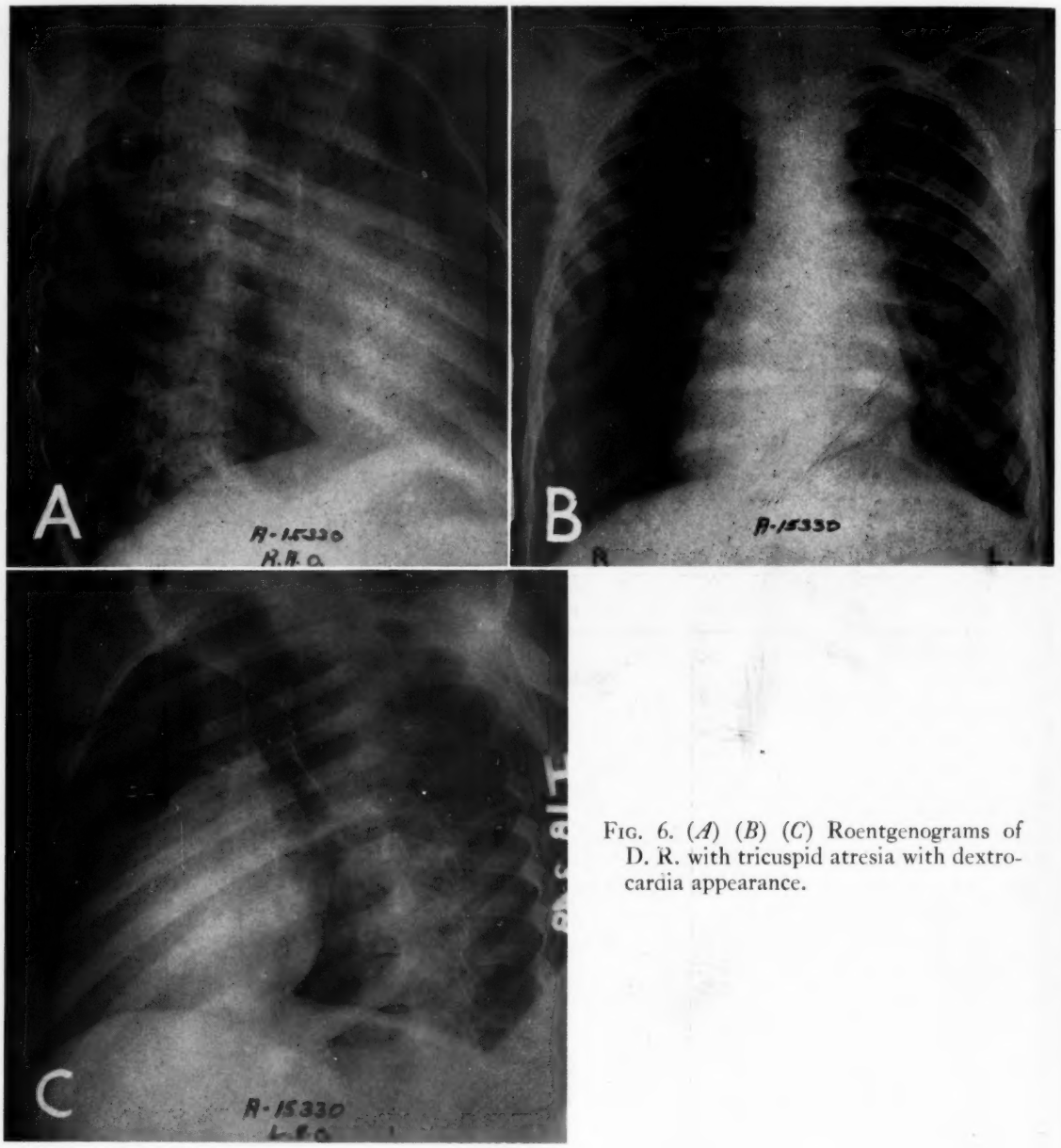

FIG. 6. (*A*) (*B*) (*C*) Roentgenograms of D. R. with tricuspid atresia with dextrocardia appearance.

Figure 4. The roentgen findings in the remaining 4 cases are almost identical and these will not be presented in detail, but to emphasize the similarity of the roentgen contour they are shown as tracings of the posteroanterior views in Figure 5.

3. *"Coeur en sabot" with dextrocardia appearance.*

Four of our cases reveal a roentgen appearance of a dextrocardia without situs inversus with a configuration similar to if not identical with that of a "mirror image" of Fallot.

As tricuspid atresia commonly produces a roentgen appearance similar to a tetralogy of Fallot, it is not unexpected that, when associated with dextrocardia, the appearance should be similar to a reversed image of a tetralogy of Fallot. What is surprising is the apparent frequency with which this occurs. Four of our 11 tricuspid atresias were apparently associated with

dextrocardia, 2 confirmed by autopsy.

The actual incidence of tricuspid atresias among dextrocardia we could not determine as some of these are not sufficiently well documented for exact diagnosis. The dextrocardia patients represent a fascinating challenge to those interested in cardiac diagnosis. In view of the current role of surgery in the cyanotic hearts these patients may prove a rewarding study. The clinical, laboratory and postmortem findings on these patients is presented in Table II, the roentgen appearance in Figures 6, 7, 8 and 9. All 4 of these patients had a left, or reversed, aortic arch. All had evidence of left ventricular preponderance by the eletrocardiogram.

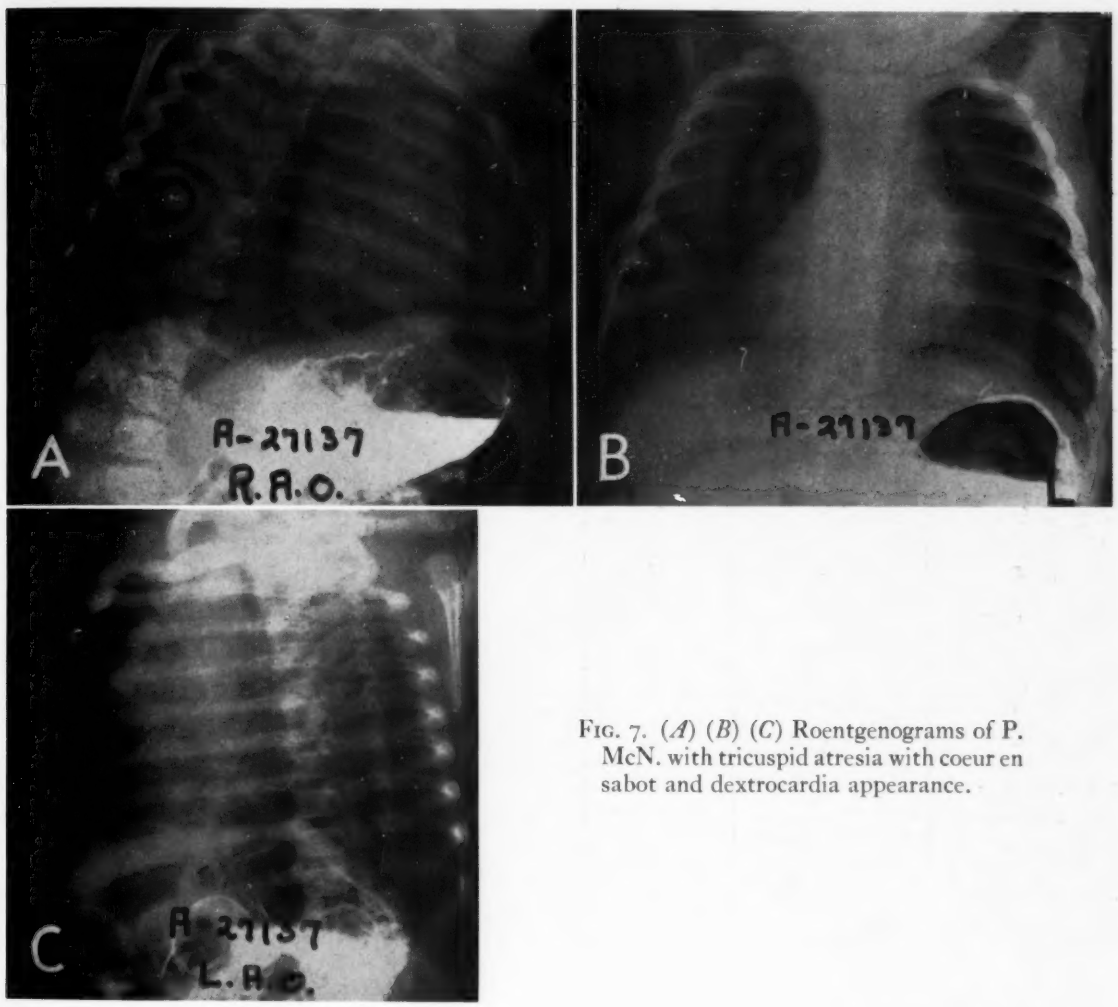

FIG. 7. (*A*) (*B*) (*C*) Roentgenograms of P. McN. with tricuspid atresia with coeur en sabot and dextrocardia appearance.

POSITION OF AORTIC ARCH

The position of the aortic arch is shown in Table III. Approximately 50 per cent of our patients with tricuspid atresia show reversal of the relationship of the aortic arch, i.e., right aortic arch in the hearts of normal position and left aortic arch in the hearts with a dextrocardia. In the group with a coeur en sabot configuration, reversal of the arch was found in 1 of the 5, or 20 per cent. This is about the same incidence of abnormal aortic arch as noted in true tetralogies.

SIZE OF AURICULAR SEPTAL DEFECT

The size of the auricular septal defect in hearts with tricuspid atresia is probably an

TABLE III

POSITION OF THE AORTIC ARCH IN 12 PATIENTS WITH TRICUSPID ATRESIA

	Normal Arch	Reversed Arch	Total
Specific configuration	1	1	2
Coeur en sabot configuration	4	1	5
Dextrocardia with coeur en sabot configuration	0	4	4
Total	5	6	11

important factor in the rate of flow of blood through the heart, as all blood passing through the heart must pass through this orifice. As Taussig[16] has emphasized, the size of the interauricular septal defect is an important factor in cardiac output as well as in the relative size of the right auricle. We feel that it is therefore also an extremely important factor in determining the roentgen configuration and, in fact, partially accounts for the variations in configuration. Figure 10 diagrammatically illustrates the mechanics involved. In Figure 10*A* the auricular septal defect is significantly

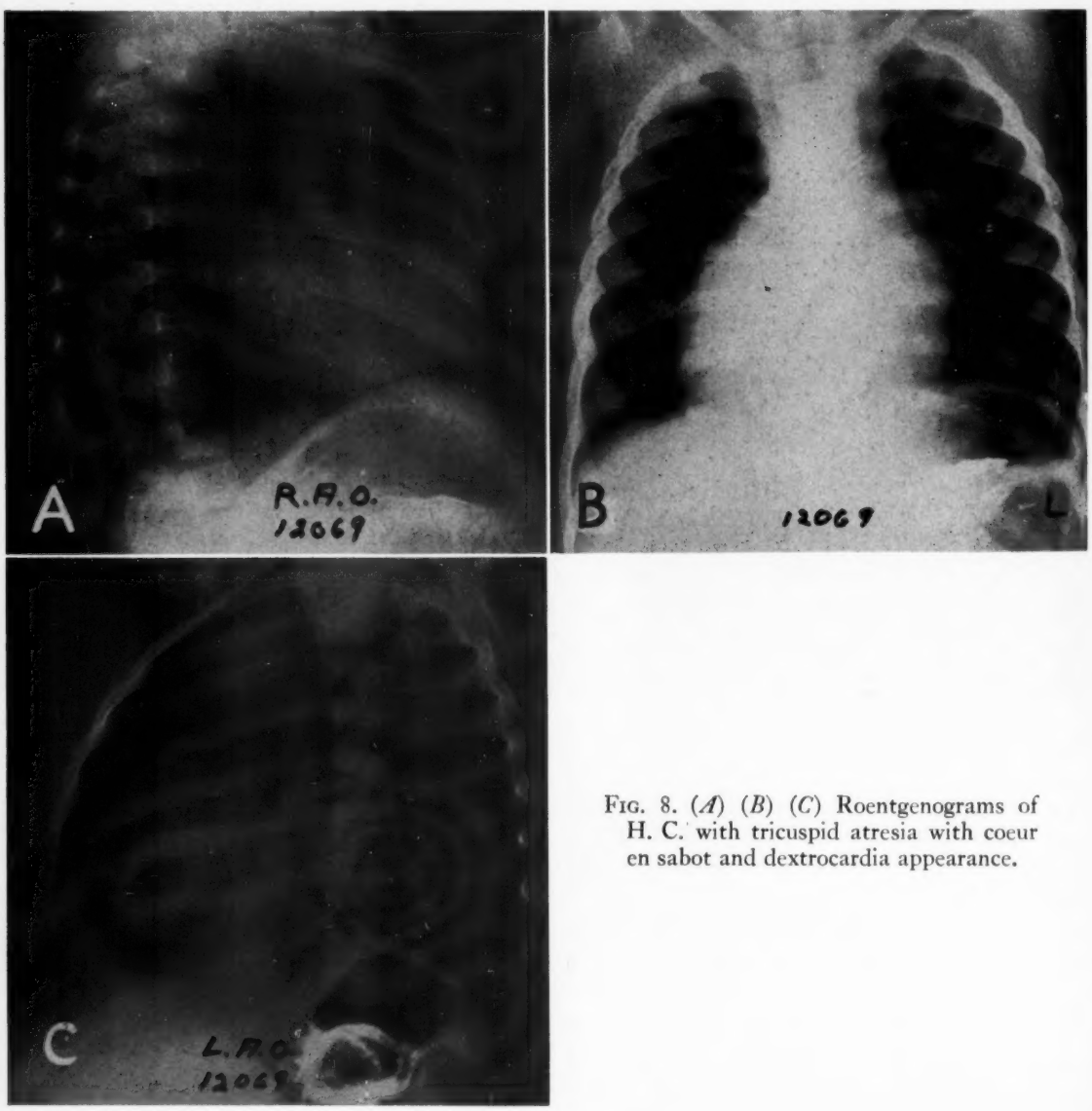

FIG. 8. (*A*) (*B*) (*C*) Roentgenograms of H. C. with tricuspid atresia with coeur en sabot and dextrocardia appearance.

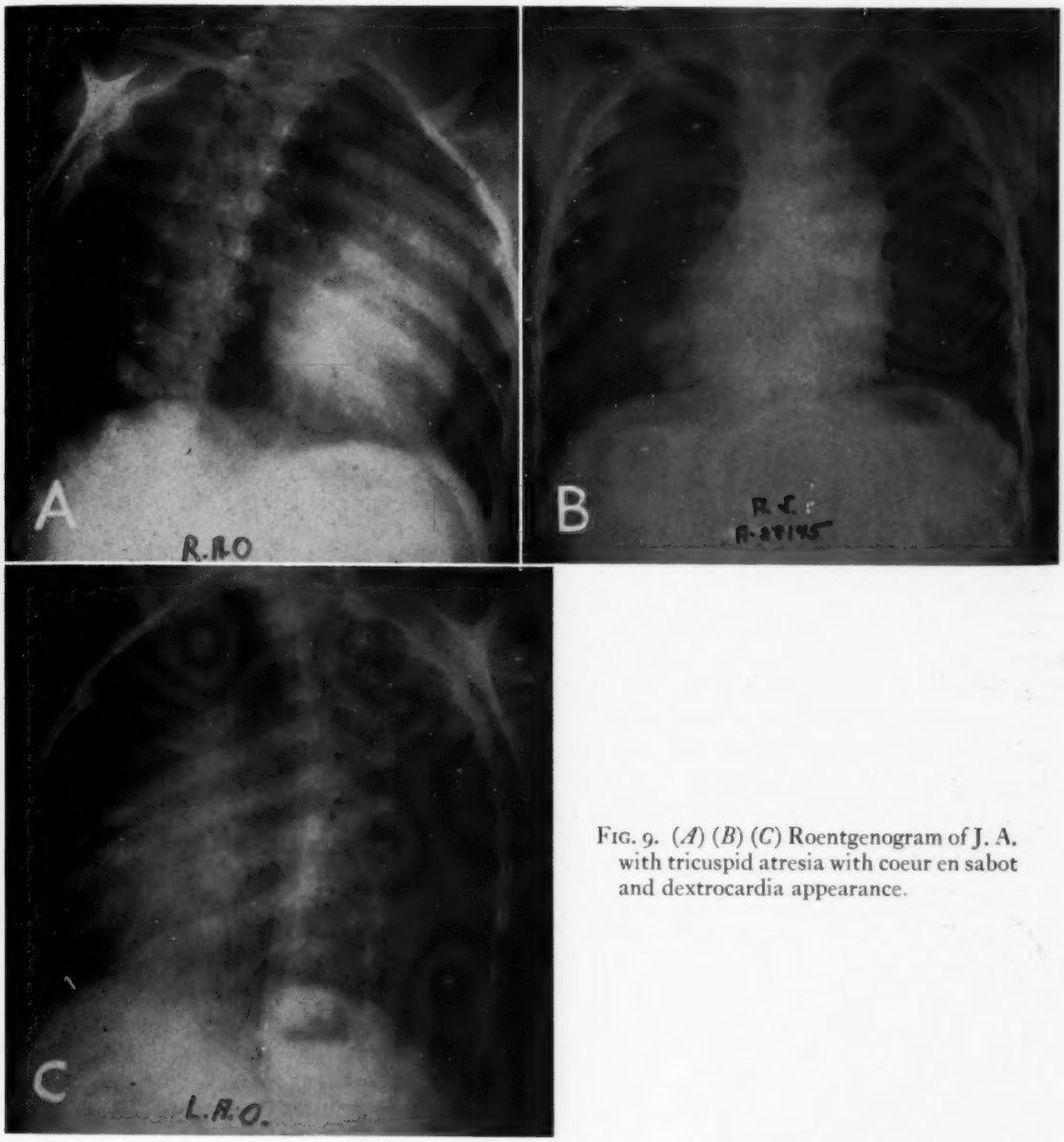

Fig. 9. (*A*) (*B*) (*C*) Roentgenogram of J. A. with tricuspid atresia with coeur en sabot and dextrocardia appearance.

larger than the mitral valve and should offer less resistance to the flow of blood than the mitral valve. In this case the auricles would not be expected to be enlarged. In Figure 10*B* the auricular septal defect is smaller. It offers definite resistance to the flow of blood relative to the mitral valve, and disproportionate right auricular enlargement should be expected. It is this mechanism which is, in part, responsible for the variation in configuration of the heart.

Table IV gives the measurements of the auricular septal defects found in our cases of tricuspid atresia which came to autopsy. As absolute measurements mean little in this varied age group, the size is given relative to the mitral orifice. Though not statistically significant, these figures support the mechanism described above. In the autopsied patient with the "characteristic" or specific roentgenographic configuration with concavity of the right and anterior borders of the heart, the auricular

TABLE IV

SIZE OF AURICULAR SEPTAL DEFECT IN TRICUSPID ATRESIA

	Average Transverse Diameter of Auricular Septal Defect	Transverse Diameter of Mitral Valve Orifice	Size of Septal Defect Relative to Mitral Orifice
	cm.	cm.	
Specific configuration	2.25	0.5	$4\frac{1}{2}$
Coeur en sabot configuration	1.1	3.6	$\frac{1}{3}$
	0.85	1.1	$\frac{3}{4}$
Dextrocardia with coeur en sabot configuration	1.2	4.5	$\frac{1}{4}$
	2.0	7.0	$\frac{1}{3}$

septal defect was four and one-half times the size of the mitral orifice; thus a grossly disproportionate enlargement of the right auricle is not expected, dramatically emphasizing the absence or hypoplasia of the right ventricle. The 4 autopsied patients without the specific roentgenographic configuration had auricular septal defects varying from one-third to three-fourths the size of the mitral orifice, thus favoring disproportionate enlargement of the right auricle. In these cases the enlarged right auricle appears to mask the absence or hypoplasia of the right ventricle.

Our postmortem findings and angiocardiograms, as well as those published by Cooley *et al.*,[5] support the thesis that it is the enlarged right auricle which rotates anterolaterally on the right to obscure the absence or hypoplasia of the right ventricle by filling in the right border of the heart, producing a cardiac silhouette similar to that in the tetralogy of Fallot.

THE PULMONARY VASCULAR MARKINGS IN TRICUSPID ATRESIA

Just as the associated cardiac defects influence the configuration of the heart, they also are a determining factor in pulmonary blood flow and influence life expectancy and operability. The size of the ductus arteriosus and the presence or absence of a functioning interventricular septal de-

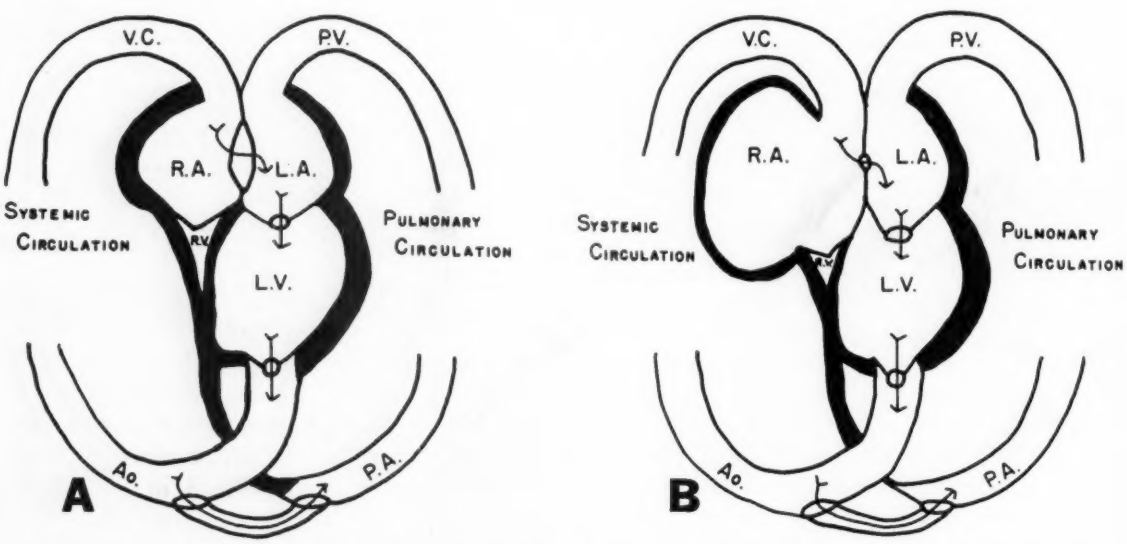

FIG. 10. Diagram illustrating postulated effect of the size of the auricular septal defect in hearts with tricuspid atresia. All blood must follow the course first through the auricular septal defect and secondly through the mitral valve. If the auricular septal defect is large relative to the mitral orifice, disproportionate enlargement of the right auricle would not be expected. If the auricular septal defect is small relative to the mitral orifice resistance to the outflow of blood from the right auricle is expected and disproportionate right auricular enlargement may result.

fect are the most common determining factors. In either case, the only roentgenographic clue is the prominence of the pulmonary vascular markings, based on the comparison of the caliber of the vessels with the normal. Secondary collateral circulation may develop sufficiently to compensate partially for the reduced pulmonary blood flow; and this condition may be recognized by the distinctive pattern of the pulmonary vascular markings, associated with a relative increase in caliber of the peripheral vascular markings as compared to the vessels in the hila. Our experience is in complete agreement with Campbell and Gardner[4] who were the first to describe the roentgen appearance in these conditions.

ANGIOCARDIOGRAPHY IN TRICUSPID ATRESIAS

Cooley *et al.*[5] report a series of angiocardiograms on 21 patients having tricuspid atresia or tricuspid stenosis, 6 of which were associated with varying degrees of transposition of the great vessels. This type of study is elucidating as it gives a more "physiologic" picture of the relative size and position of the auricles than postmortem appearances, where, of course, the right auricle is often disproportionately enlarged by terminal dilatation in patients dying of congestive failure. They emphasize that "angiocardiography does not demonstrate tricuspid atresia *per se*, but merely indicates a mal-functioning right ventricle," and in only 2 of the 21 patients did angiocardiography supply "vital information which has been previously unsuspected." "Since the desired information is not invariably provided by angiocardiography, we must balance its advantages against its risks" in this case an approximately 1 per cent mortality. This statement is worth re-emphasis in view of the fact that this is a diagnostic procedure of strictly limited value.

ROENTGEN EVALUATION OF OPERABILITY

In the past many of the children with tricuspid atresia who reached the age at which surgery has been commonly performed, either have already developed some compensatory blood flow through the bronchial arteries, or had a significant functioning interventricular septal defect. It is probably for these very reasons that they have reached an "operable" age.

Children with congenital tricuspid atresia may be handicapped as a result: (a) of inadequate pulmonary blood flow due to too small a left to right shunt by the small caliber or closure of the ductus arteriosus, or (b) of diminished or inadequate cardiac output resulting from an auricular septal defect too small to be consistent with life. Obviously, if the latter is the case, adding a left to right shunt to increase pulmonary blood flow, as in the Blalock or Pott's procedure, will not increase the total cardiac output. If these cases are to be improved, enlargement of the auricular septal defect would be a prerequisite. We believe that many of the early deaths in tricuspid atresias are more often attributable to limitation of cardiac output than diminished pulmonary blood flow.

We have perhaps failed to recognize the full significance of the size of the right auricle in these cases and its possible significance in judging the functional size of the auricular septal defect. In the light of present knowledge, it is hoped that the radiologist may offer more information regarding the size of this abnormally placed structure in tricuspid atresia as an aid towards selecting the proper surgical procedure.

The pulmonary vascular markings are the radiologist's main clue to the state of the pulmonary blood flow. Diminution in the degree of compensation of, or actual increased pulmonary blood flow may be recognized by the radiologist with experience, particularly if constant note is made of the variations of normal in each age group.

Increased vascularity of the lung fields with or without hilar dance almost invariably indicates partial transposition of the great vessels in tricuspid atresia. Present surgical techniques may be directed toward the enlargement of the auricular septal de-

fect if this is the probable limiting factor or by the creation of an additional left to right shunt to increase the pulmonary blood flow if this is the primary handicap.

It is perhaps lack of general recognition of these factors which has created the impression that the tricuspid atresias as a group do not respond as well to palliative surgery as do the tetralogies of Fallot. References to postoperative response in individual cases may be found in the literature.[8,15] Although a series of reported cases is not available, one gains the impression from the medical literature that 40 per cent or less have shown a favorable response to palliative surgery in the past.

VARIANTS OF TRICUSPID ATRESIA AND DIFFERENTIAL DIAGNOSIS

This discussion would not be complete without emphasizing the frequent association of partial or complete transposition of the great vessels associated with tricuspid atresia as well as with the dextrocardias. These have not been reported in this study, as at the present time no specific therapy is available. However, they may plague the cardiologist and surgeon in the differential diagnosis. The radiologist may offer valuable assistance in sorting out these variations.

The conventional textbook grouping of cyanotic congenital heart disease for differential diagnosis usually includes:

1. Tetralogy of Fallot
2. Isolated pulmonary stenosis
3. Eisenmenger complex
4. Truncus communis persistans
5. Transposition of great vessels
6. Dextrocardia variants
7. Tricuspid stenosis or atresia
   a. without transposition of the great vessels
   b. with transposition of the great vessels

In this differential group it is our experience that, with the exception of the knowledge of cyanosis and the age of the patient, clinical history is of little help.

As previously noted, in examining the cyanotic child in the first few days or weeks of life the possibilities seem almost infinite as the recognizable structural changes of the heart may be minimal. In the 11 cases reported the diagnosis was made within the first year of life in 9 patients; in 1, the diagnosis could not be established until the twelfth year of life and 1 was not examined until the fourth year of life.

Under twelve years of age patients with isolated pulmonary stenosis, most with Eisenmenger complexes, and many with truncus communis persistans present no cyanosis. The true truncus and practically all the patients with transposition of the great vessels (either with or without associated tricuspid atresia) will usually show evidence of mild to moderate pulmonary vascular engorgement in addition to the described deformity of the base of the heart and the usual electrocardiographic evidence of the right ventricular hypertrophy.

Cyanosis in dextrocardia of course indicates an additional lesion besides a simple mirror image of the normal heart. If the pulmonary vascular markings are diminished and the cardiac waist narrowed on the right, where the pulmonary artery normally lies, one must always suspect tricuspid atresia, particularly if the configuration of the cardiac shadow simulates a reversed tetralogy of Fallot. The electrocardiogram in these cases is difficult to interpret and left ventricular preponderance may not be recognized unless unipolar leads are taken over the right side of the chest. It is in this isolated group of dextrocardias with cyanosis and diminished prominence of the pulmonary vascular markings that the risk of angiocardiography may well be justified.

The practical problem resolves itself into the differentiation of the tetralogy of Fallot from the tricuspid atresia without transposition of the great vessels. The few tricuspid atresias with the specific appearance offer no difficulty. The remainder may be and usually are roentgenographically indistinguishable from the tetralogy of Fallot. In this case the electrocardiogram may offer the only differential clue.

SUMMARY

1. The roentgen findings in eleven patients with congenital tricuspid atresia, and the differential diagnosis in cyanotic heart disease are discussed.

2. Divided according to roentgen appearance these hearts fell into three groups:

a. "Characteristic" or "specific" appearance.

b. "Coeur en sabot" appearance.

c. "Coeur en sabot" with dextrocardia appearance.

3. The "characteristic roentgen appearance" of tricuspid atresia was observed in only two patients.

4. The majority of tricuspid atresias have the "coeur en sabot" appearance resembling the tetralogy of Fallot. In this differential the electrocardiogram has decisive value.

5. The possible mechanism producing the variations in appearances and the roentgen features in evaluation of operability are discussed.

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REFERENCES

1. Abbott, Maude E. Congenital cardiac disease. In: Modern Medicine. Edited by W. Osler. Re-edited by T. McCrae. Lea & Febiger Philadelphia, 1927, Vol. 4, p. 612.

2. Abbott, Maude E. Atlas of Congenital Cardiac Disease. American Heart Association, New York, 1936.

3. Alexander, F., and White, P. D. Four important congenital cardiac conditions causing cyanosis to be differentiated from tetralogy of Fallot; tricuspid atresia, Eisenmenger's complex transposition of great vessels and single ventricle. *Ann. Int. Med.*, 1947, *27*, 64–83.

4. Campbell, M., and Gardner, F. Radiological features of enlarged bronchial arteries. *Brit. Heart J.*, 1950, *12*, 184.

5. Cooley, R. N., Sloan, R. D., Hanlon, C. R., and Bahnson, H. T. Angiocardiography in congenital heart disease of cyanotic type. II. Observations on tricuspid stenosis or atresia with hypoplasia of right ventricle. *Radiology*, 1950, *54*, 848–868.

6. Eek, S., and others. Morbus Caeruleus. Edited by E. Mannheimer. S. Karger, Basel, 1949.

7. Gibson, S., and Clifton, W. M. Congenital heart disease. *Am. J. Dis. Child.*, 1938, *55*, 761–767.

8. Holman, E. Discussion of paper by Stauffer.[15]

9. Nadas, A. S., Josephs, L. G., Mussell, B. F., and Alimurung, M. M. Electrocardiographic patterns in operable congenital heart disease. To be published.

10. Neuhauser, E. B. D. Recent advances in roentgenographic diagnosis of congenital malformation of heart and great vessels. *New England J. Med.*, 1950, *242*, 753–758.

11. Peck, Dorothea R., and Wilson, H. M. Conventional roentgenography in diagnosis of cardiovascular anomalies. *Radiology*, 1949, *53*, 479–487.

12. Robinson, A., and Howard, J. E. Atresia of tricuspid valve with transposition of great vessels. *Am. J. Dis. Child.*, 1948, *75*, 575–581.

13. Shapiro, M. J. Diagnosis of congenital heart disease by ordinary methods. *Radiology*, 1949, *53*, 469–478.

14. Sosman, M. C. Specificity and reliability of roentgenographic diagnosis. *New England J. Med.*, 1950, *242*, 849–855.

15. Stauffer, H. M. Conventional roentgen examination in operable congenital heart disease. *Radiology*, 1949, *53*, 488–499.

16. Taussig, Helen B. Congenital Malformations of the Heart. E. L. Hildreth & Co., Inc., New York, 1947.

17. Wood, P. Congenital pulmonary stenosis with left ventricular enlargement associated with atrial septal defect. *Brit. Heart J.*, 1942, *4*, 11–16.

EARLY ROENTGEN DIAGNOSIS IN ACUTE BLEEDING FROM THE UPPER GASTROINTESTINAL TRACT

II. ROENTGEN ASPECTS*

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MOST cases of acute bleeding from the upper gastrointestinal tract are managed medically. However, it has been demonstrated that the mortality in patients requiring emergency surgery rises progressively with increased delay in the institution of surgical measures. The early diagnosis of the cause of the bleeding is always desirable and in some instances is imperative to save the life of the patient. The exact localization of the site of bleeding is of paramount importance to the surgeon in order to lessen the necessity for exploratory procedures and to facilitate the surgical therapy. The exclusion of the presence of a lesion which is not amenable to surgery reduces the mortality in cases of acute hemorrhage by preventing unwarranted laparotomy. In the past it was customary to defer attempts to determine the cause of the hemorrhage by roentgen methods until the bleeding had subsided or ceased entirely and the patient's condition had improved. Prior to the widespread use of gastrectomy, any diagnostic procedure or manipulation which might increase the bleeding was carefully avoided. Roentgen studies, therefore, were not utilized during the phase of acute bleeding. With the greatly lowered mortality attendant on gastric surgery today, the importance of early diagnosis is greatly enhanced.

In 1936, Hampton[4] recommended roentgenoscopy in the supine position after the ingestion of small amounts of opaque material in an attempt to establish an early diagnosis of the cause of the bleeding. His observations were limited to studies with slight rotation of the patient from side to side in an attempt to fill the duodenal bulb with air and opaque material. He did not recommend maniputation or palpation and did not feel it advisable to utilize the erect or prone position. In 1941, Bohrer[1] stated that roentgen examination during bleeding was forbidden, but that if it were attempted the elimination of manipulation and pressure was essential. The following year Kiefer,[8] in discussing jejunal ulcers and recurrent hemorrhages, recommended roentgenoscopy and numerous spot films in an attempt to determine (1) the presence or absence of localized tenderness; (2) areas of narrowing; (3) rigidity of the stomach and duodenal wall; (4) obliteration of the normal mucosal folds; and (5) funnelling of the stoma. Thorstad[11] in the same year stated that barium could be given early by mouth, the danger being not in the utilization of the opaque meal but in the trauma to the viscera by the manipulation attendant on the observations and examination. Eads[3] stated that roentgen examination might safely be made two weeks after the bleeding or as soon as the physician felt that additional hemorrhage would not be provoked. Schatzki,[10] in 1946, recommended examination by roentgen methods shortly after the bleeding had stopped or even during bleeding but only when the patient was not in shock. He also stressed that the examination must be made without palpation and stated that in his opinion it appeared reasonable to wait at least twenty-four to forty-eight hours after an acute, massive hemorrhage before undertaking

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roentgen studies. All these observers were of the belief that the examination should not be made with the patient erect and that pressure studies were contraindicated.

The combined medical, roentgenologic, and surgical approach to the study of acute bleeding from the upper gastrointestinal tract has recently been emphasized by several authors including Heuer,[5] Hoerr *et al.*,[6] Jones[7] and Warthin, Warren and Wissing.[12] During the past year, a concerted attack on this difficult problem has been made at the Boston City Hospital. A total of 52 patients with acute bleeding from the esophagus, stomach, and/or duodenum was carefully studied by clinical and roentgen methods and comprises the basis for this report. A more detailed discussion of the clinical aspects of this study will be found elsewhere,[14] including a report of additional patients studied. At the Boston City Hospital, all patients with massive hemorrhage from the gastrointestinal tract were admitted to the medical ward for diagnosis and therapy. The patients who required emergency surgery were transferred to the surgical service as soon as a decision for laparotomy was made. Since the patients with acute hemorrhage from the gastrointestinal tract were first observed and treated medically, it was the duty of the medical service to consult with the surgical and roentgenologic departments in order to select the patients who required emergency surgery as early as possible.

SELECTION OF PATIENTS FOR EMERGENCY ROENTGEN EXAMINATION

Immediately after admission of the patient, a complete history was taken and the physical examination made. Fluid and blood replacement was vigorously instituted. Sedation in the form of barbiturates or demerol was administered unless contraindicated. Oral feeding was frequently utilized early. If the patient was bleeding so severely that the possibility of immediate surgery arose, food was withheld entirely or limited to gruel and cooked cereal prepared with thin milk alternating with water and antacids. This regimen was preferred to whole milk or cream which are less easily digested and tend to form undesirable curds in the stomach. The roentgen examination was usually carried out on the morning following admission on all patients with the exception of the following: (1) Individuals who presented evidence on the morning of the scheduled roentgen study of very severe hemorrhage consisting of gross hematemesis, liquid melena, or mushy stools containing large amounts of blood. A solid black stool was not considered evidence of active bleeding at the time the stool was passed. In patients with evidence of severe, active bleeding the examination was delayed, usually for not more than twenty-four to forty-eight hours. In some cases, emergency surgery was performed prior to roentgen examination if severe, continued bleeding persisted. (2) Patients who manifested clinical shock at the time of the scheduled examination by one or more of the following signs: definite fall in blood pressure, rise in pulse, marked apprehension, pallor, and cooling of the extremities. Marginal shock or mild states of shock did not comprise contraindications to carrying out the roentgen examinations. (3) Patients who were unable to cooperate, particularly those with delirium tremens. (4) Individuals with serious medical complications. All other patients with acute bleeding were sent routinely for roentgen study. Alterations of pulse and blood pressure in addition to intake of food, fluids and medications, the output of urine, vomitus, and melena were recorded on a bedside chart throughout the hours immediately after admission. These data were needed for comparison with those observed on the day of the roentgen study. Transfusion was utilized freely with the aim of raising the hematocrit to approximately 30 per cent prior to the roentgen study. Blood was immediately available in the blood bank. The surgical consultant was informed of the patient's condition in the event that emergency surgery became necessary. The pa-

FOR EMERGENCY GASTROINTESTINAL SERIES OF PATIENTS WITH UPPER GASTROINTESTINAL HEMORRHAGE

Name of Patient Age Date of Requisition

Ward Service Hosp. No. Date and Hour of Admission

ADMISSION:

Degree of Shock on Admission to Ward:

None ☐ Pulse

Mild ☐ B.P.

Moderate ☐ Hematocrit

Severe ☐ BSP

MORNING OF G.I. SERIES: B.P. Pulse Hematocrit

Preliminary Diagnoses:

Above data to be completed by Ward Physician

DATE AND HOUR OF FLUOROSCOPY:

Before exam.—B.P. Pulse

After exam. —B.P. Pulse

Extent of Examination: Complete ☐ Without pressure ☐ Without standing ☐

Patient's Tolerance of Procedure: Good ☐ Fair ☐ Poor ☐

Duration of Examination:

Fluoroscopic Findings:

Comments:

Final Roentgen Diagnosis:

FIG. 1. Form used to request roentgen study in patients with acute bleeding from the upper gastrointestinal tract.

tient was given nothing by mouth for at least twelve hours prior to the examination, although in certain cases this period was shortened to eight to ten hours. The advantages of a complete roentgen study were considered to outweigh the disadvantages of withholding food and oral therapy. With very sick individuals, a member of the medical staff accompanied the patient to the roentgen department and remained with him throughout the examination. Pulse and blood pressure tests were made before and after the roentgen examination and during the procedure when indicated (Fig. 1). In the event of a change in the condition of the patient during the roentgen examination, the responsibility for continuing and completing the studies rested with the attending physician and the radiologist. After the termination of the roentgen studies, half hourly pulse and blood pressure recordings were made at the bedside. Frequent hematocrit or hemoglobin determination was made when indicated, usually at intervals of six hours during the twenty-four to forty-eight hours after the roentgen examination.

Patients bleeding from varices of the

esophagus comprised a special group since surgical intervention was contraindicated. Patients in this group were screened rapidly with the help of the bromsulfalein test.[13] A persistently elevated value was consistent with cirrhosis, whereas normal values obtained during bleeding excluded this diagnosis. The presence of bleeding esophageal varices was then established by esophagoscopy carried out as an emergency bedside procedure[2] or by roentgen examination, although the severity of bleeding at times necessitated delaying the latter until the bleeding had subsided. It should be emphasized that a patient may be bleeding from a lesion in the stomach or duodenum despite the coexistence of esophageal varices, and accordingly roentgen studies were done when esophagoscopy revealed varices which were not bleeding.

METHOD OF ROENTGEN STUDY

The roentgen examination was not carried out in routine fashion. For optimum results, the study was individualized according to the condition of each patient. It was our practice to make the examination as detailed and complete as possible in order to obtain the maximum amount of information without endangering the patient. In our series of 52 patients, those who were considered too ill to stand were examined only in the recumbent position. The opaque mixture was administered through a drinking tube. No palpation or pressure was applied to the abdomen. The progress of the meal through the esophagus and into the stomach was observed carefully. The patient was turned from the supine into the prone and various oblique positions. Spot and routine roentgenograms were made. In the patients who were able to stand, the studies were begun in the erect position and the screen centered over the cardioesophageal junction. The barium column was observed carefully in its passage through the esophagus and as it entered the stomach and coursed along the lesser curvature to the antrum. The patient was also observed in the recumbent, supine and prone positions. Various oblique positions were utilized in order to outline the antrum, the duodenal cap and the entire duodenal loop. Air contrast visualization was obtained by turning the patient from the prone to the supine position. In no instance was the examination limited to the stomach and the first portion of the duodenum as it was considered essential to visualize the entire duodenal loop and the upper jejunum before the examination was terminated. Multiple spot roentgenograms were made in different positions during the roentgenoscopy. Three patients were very ill and consequently could be examined only in the recumbent position. Manipulation and palpation were not used and the patients were moved gently and as little as possible during the roentgen studies. Roentgenoscopy including spot roentgenograms without pressure was performed and routine films were made in the supine, prone, and oblique positions. In 44 patients, the roentgen study was carried out in both the erect and recumbent positions with manual pressure applied to the stomach and duodenum. The palpation was performed gently with the gloved hand, excessive pressure, massage or the sudden application of marked force being avoided. Mechanical pressure devices were not utilized. Spot and routine roentgenograms were made in these cases. In 5 individuals, the studies comprised detailed roentgenoscopic and roentgenographic studies in both the upright and recumbent positions, including complete, careful palpation and mechanical pressure.

Early in our series, all cases and later the very ill patients were accompanied to the roentgen department by a member of the medical staff whose duty it was to observe the patient's condition and record the pulse and blood pressure before, during and after the examination. This was felt to be advisable since the red glasses worn by the radiologist in order to retain proper accommodation prevented observation of the color and condition of the patient in the intervals between the roentgenoscopic observations when the room lights were on. After we had acquired experience with this

type of case, it was no longer deemed necessary to have the clinician present during the roentgenoscopy. The radiologist or the nurse made and recorded the pulse and blood pressure observations prior to the administration of the meal and after completion of the examination. During the roentgen studies, the patient's condition was noted by the radiologist and the studies were discontinued or interrupted if necessary.

The optimum time for carrying out the roentgen study was decided by the clinician and the radiologist. It was considered essential that the patient fast for approximately twelve hours prior to the roentgenoscopy, although in urgent cases this period was shortened to eight hours, as retained food and secretion often obscured important details and prevented satisfactory study, particularly in the presence of small lesions. The importance of careful preparation is emphasized by the fact that once the barium meal had been administered it was not possible at times to repeat the observations for twelve to twenty-four hours or longer because the retained opaque material in the stomach and intestines obliterated essential details. The presence of blood in the stomach was unpredictable and when present caused an unsatisfactory examination. Fluid blood diluted the opaque material and obscured the details of the stomach and duodenal contours. Clotted or fluid blood produced intraluminal masses and mottlings which closely simulated polypoid or infiltrative neoplasms (Fig. 6). In order to minimize movement of the patient, six and twenty-four hour observations were not made routinely. However, in doubtful cases, observations after three or six hours afforded important additional data concerning the emptying time of the stomach and were used when indicated.

Thin barium mixtures were utilized except in the search for esophageal varices. Small amounts of the opaque material were preferable in most instances, the patient being given three or four swallows, totalling approximately four ounces of fluid barium. It was not necessary to use large amounts of the opaque material in any instance and, on the contrary, most lesions were diagnosed more satisfactorily with the smaller quantities. In the demonstration of hiatus hernias, complete filling of the stomach was helpful in some instances. The esophagus of every patient was carefully studied for varices. Routinely, the stomach and duodenum were examined with small amounts of liquid barium mixtures and roentgenograms made. Subsequently, an opaque paste was administered for the study of the esophagus.

The time which elapsed between the admission of the patient to the hospital and the performance of the roentgen studies was as follows:

Time	Number of Cases
Less than 12 hours	7
13–24 hours	15
25–48 hours	11
49–72 hours	10
73–96 hours	4
5– 6 days	4
1 week	1

Twenty-two cases, or 42 per cent, were studied within twenty-four hours; 33 cases, or 63.5 per cent, in forty-eight hours of the time of entry, and approximately 83 per cent in less than seventy-two hours after admission.

ROENTGEN FINDINGS (SEE TABLE 1)

Esophageal varices were diagnosed in 3 instances. For the demonstration of varices,

TABLE I

SUMMARY OF ROENTGEN FINDINGS*

	Cases
No demonstrable pathology	9
Esophageal varices	3
Hiatus hernia	6
Gastritis	12
Gastric carcinoma	1
Gastric ulcer	10
Duodenal ulcer	22
Duodenitis	4
Duodenal diverticulum	6
Stomal ulcer	2

* The number of diagnoses indicated in this table exceeds the total number of patients as more than one lesion was found in several of the patients.

a barium paste of the consistency of thin gruel was preferable to the liquid meal which was utilized in the study of the stomach and the duodenum as the heavier opaque mixture adhered to the esophageal wall and afforded sharper contrast. We preferred a mixture of barium and water without the addition of acacia or other foreign material. Complete filling of the esophagus was avoided. The defects produced by the varices were best visualized after the greater portion of the ingested opaque meal had emptied into the stomach, leaving only a thin coating adhering to the wall of the esophagus. The varices were visualized as multiple, small, rounded areas of increased radiance within the lumen of the esophagus. The changes were most marked in the lower and middle thirds of the esophagus, the lower portion being the most common site of involvement. The areas of increased radiance within the lumen of the esophagus were best visualized during full expiration. The Valsalva and the Mueller maneuvers were not helpful. Patients who were able to swallow air with or immediately after the ingestion of the opaque medium showed sharper delineation of the esophageal lesions than patients unable to swallow air. It was definitely helpful to place the patient in the Trendelenburg position as this resulted in slower passage of the opaque material through the esophagus and permitted more extensive and careful roentgenoscopic observations. The left posterior oblique and the right anterior oblique positions were most useful, the former tending to result in greater magnification. It was important that multiple spot films be made during the roentgenoscopic study and routine roentgenograms taken in every instance as the defects associated with small types of varices were in many cases not visualized roentgenoscopically. This was particularly true in the presence of an enlarged heart or marked tachycardia, since the cardiac pulsations increased the difficulties in the visualization of the varices. It was essential that the roentgenoscopist place the patient in the correct position for the demonstration of the lesions during the taking of the roentgenograms as slight malposition sufficed to obscure or obliterate the changes. In our experience it was preferable to make the routine roentgenograms on the roentgenoscopic table immediately after the conclusion of the roentgenoscopic studies because moving the patient to another roentgen-ray room or allowing the technician to make the films in a routine manner seldom resulted in proper delineation of the lesions. Small air bubbles presented an appearance similar in many respects to that seen with varices. However, air bubbles were variable in size, shape, and position and were usually inconstant on subsequent re-examination. Careful study made exact differentiation possible and prevented confusion in diagnosis.

A hiatus hernia was demonstrated in 6 patients of this series. Five of the patients with hiatus hernia were found to have another lesion which afforded a more probable explanation of the bleeding. Four had duodenal ulcer and 1 had marked gastritis. The last case of this group showed a large diverticulum of the second portion of the duodenum. The herniations of the stomach through the esophageal orifice of the diaphragms were rarely visualized in the upright position. In our experience this type of hernia was best demonstrated with the patient in the Trendelenburg position and with the stomach well filled with the barium mixture. Dilatation of the distal end of the esophagus, the so-called phrenic ampulla of the esophagus, may easily be confused with a hiatus hernia. It is essential that the length and contour of the esophagus be carefully noted in every instance. The Valsalva maneuver, attempted forceful expiration with the epiglottis closed at the end of a full inspiration, was helpful in the demonstration of small or easily reducible types of hernias. The lower segment of the esophagus and the stomach was studied carefully in every case since the demonstration of a hernia did not preclude the presence of other coexisting lesions which in some cases were more important than the hernia itself.

FIG. 2. *Gastritis.* The gastric mucosa is coarse and markedly thickened, the characteristic manifestation of gastritis. The patient entered the hospital with severe bleeding from the upper gastrointestinal tract. Surgical intervention was impossible because of advanced cardiovascular disease. Death ensued six weeks later. Postmortem studies were carried out. Pathologic report: Gastritis.

Gastritis was present in 12 patients of our series. The roentgen diagnosis of gastritis was established by the presence of marked coarseness and thickening of the mucosa of the stomach (Fig. 2). There frequently also occurred increased peristaltic activity with several, deep, vigorous waves which passed rapidly along the stomach. Rapid emptying of the stomach and duodenum was also present in some instances. Duodenitis was usually found in association with gastritis. The use of small quantities of barium meal was of great value for the demonstration of the mucosal changes in the stomach and the duodenum as even moderate filling of the stomach was apt to cause obliteration of the mucosal relief (Fig. 3). The supine and right anterior oblique positions afforded the most satisfactory air contrast visualization of the media and antrum and were very helpful in the demonstration of gastritis. The presence of retained secretion, food and clotted blood sometimes simulated gastritis closely. It was necessary in such cases to re-examine

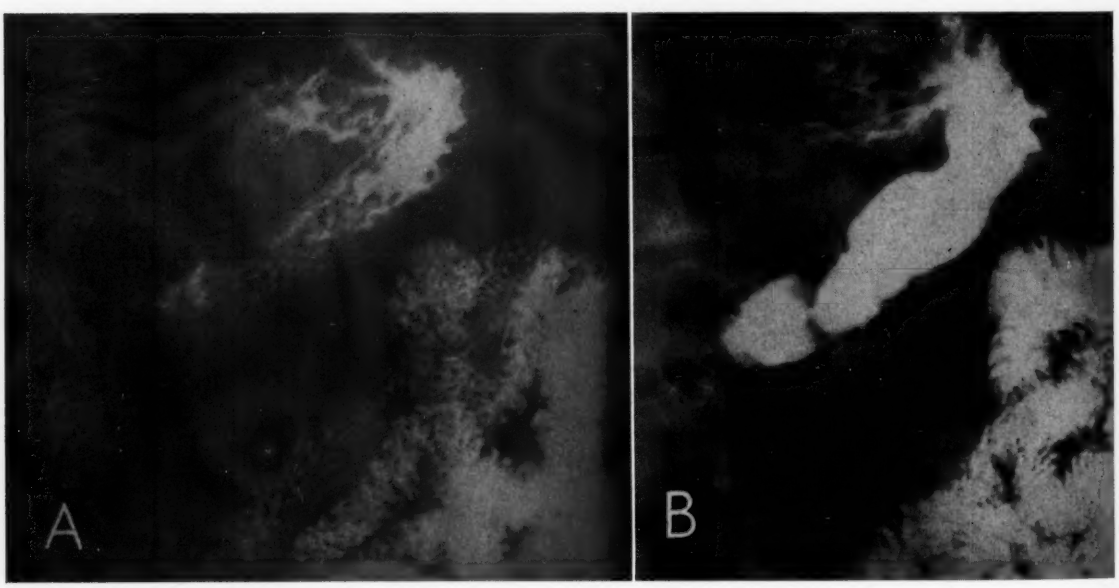

FIG. 3. *Gastritis and Duodenitis.* (*A*) Roentgenogram with only a small amount of the opaque material in the stomach. The mucosa of the stomach and duodenum is coarse and markedly thickened. There are multiple, superficial irregularities of gastric and duodenal contour. (*B*) After complete filling of the stomach. The changes are obscured and diagnosis becomes practically impossible, illustrating the importance of using small quantities of the opaque material.

The stomach was resected. Pathologic study revealed hemorrhagic gastritis and duodenitis.

the patient in order to establish the constancy of the findings before a diagnosis of gastritis could definitely be made by roentgen methods. Multiple, small, superficial irregularities of gastric contour were frequently present and constituted an important manifestation of gastritis. The irregular defects involved both the greater and lesser curvature aspects, imparting a serrated margin to the stomach. These changes were usually found to be variable during the examination and at subsequent re-examinations. The multiplicity and variability of the serrations differentiated them from superficial ulcer crater formations with which they may easily be confused. It should be borne in mind that peptic ulcer frequently occurs in association with gastritis and must be carefully sought for in every instance. Antral gastritis was characterized by narrowing, irregularity of contour, and limited distensibility or rigidity of the involved portion of the stomach (Fig. 4). The changes were localized to a relatively small area in some instances, while

Fig. 4. *Antral Gastritis.* There is marked narrowing and irregularity of contour of the distal third of the stomach. The duodenum fills well and is smooth in outline. The changes in the stomach were constantly present on three successive roentgen studies. At operation, marked antral gastritis was found.

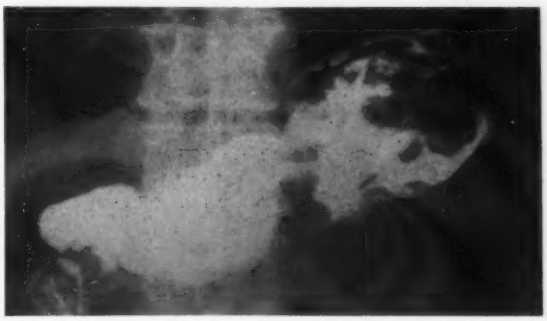

Fig. 5. *Carcinoma of the Cardia of the Stomach.* The patient entered the hospital during an episode of severe, acute upper gastrointestinal tract bleeding. There was a large, irregular, filling defect within the lumen of the cardia of the stomach. It was at first considered that the changes in the cardia of the stomach might be due to clotted blood. Re-examination three days later revealed no change in the roentgen manifestations. Roentgen diagnosis of carcinoma of the cardia was confirmed by operation.

in others a segment several centimeters in length was affected. Peristalsis frequently passed through the involved area, which was of great aid in establishing the diagnosis. More commonly, peristaltic activity was markedly lessened or entirely absent, being diminished or arrested at the proximal margin of the lesion. The differentiation from spasm, adhesions, scarring, carcinoma, or other indurative and ulcerative lesions was frequently difficult or impossible by roentgen studies alone. The presence of coarse, thickened mucosal folds in the antral region was an important manifestation of antral gastritis, although in many instances it was impossible to visualize the mucosal pattern in the affected portion of the stomach.

One patient in our series presented a carcinoma of the stomach, the neoplasm involving the fundus. At the first examination, there was extensive intraluminal mottling with irregularity of contour in the region of the cardia of the stomach. It was considered at first that the changes might possibly be due to clotted blood. Re-examination revealed that the intraluminal defect and irregularity of outline were constant (Fig. 5). Gastroscopy showed a necrotic mass in the region of the cardia.

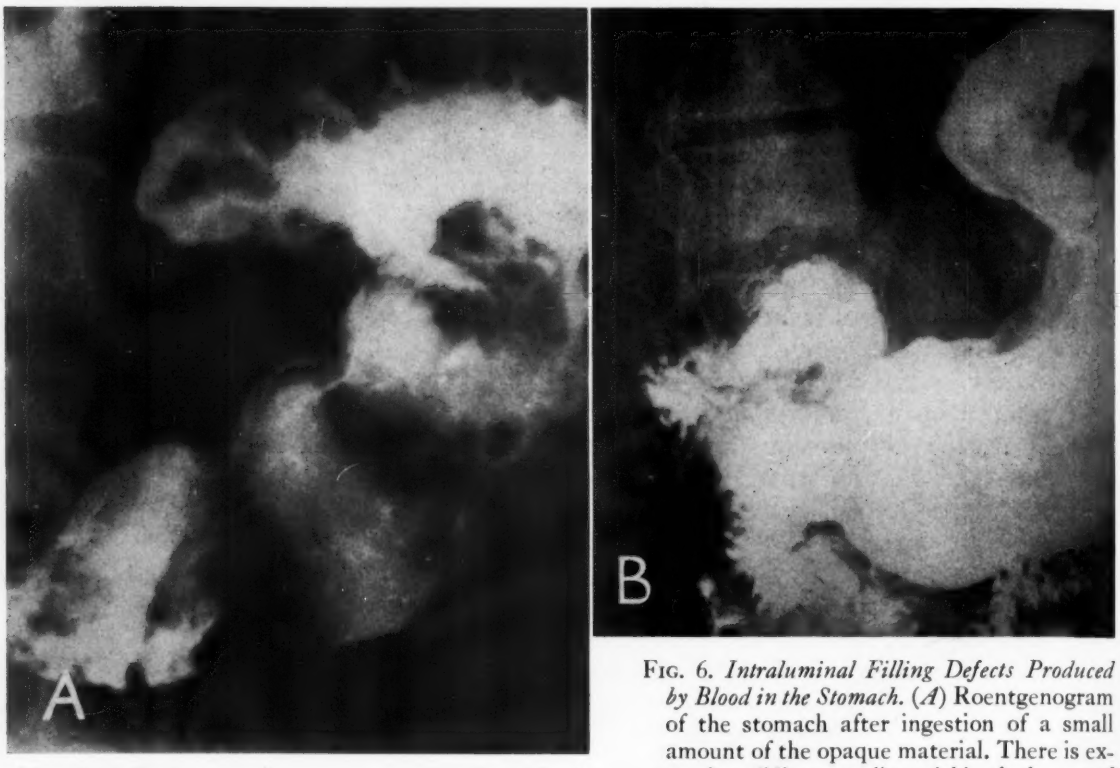

FIG. 6. *Intraluminal Filling Defects Produced by Blood in the Stomach.* (*A*) Roentgenogram of the stomach after ingestion of a small amount of the opaque material. There is extensive, diffuse mottling within the lumen of the stomach. On roentgenoscopy, the intraluminal mottling was variable in position and character. (*B*) After more complete filling of the stomach. The defects in the media and antrum are less marked. The intraluminal mottling in the region of the cardia is more localized.

The patient entered the hospital in mild shock because of acute bleeding from the upper gastrointestinal tract. There was severe hematemesis. Operation revealed hemorrhagic gastritis. There were large amounts of blood in the stomach. Gastric resection was performed.

Gastrectomy was performed and microscopic study proved the presence of adenocarcinoma. Since blood clots may simulate neoplasm very closely, it was essential to establish the constancy of the changes before a definite diagnosis of carcinoma of the stomach was made (Fig. 6). Observations with the patient upright may show a filling defect or mass within the air bubble of the stomach in neoplasm of the fundus. This was first described by Kirklin and Gilbertson[9] who indicated that carcinoma of the gastric cardia can in some instances be diagnosed on routine roentgenograms of the chest.

In 10 instances gastric ulcer was demonstrated on roentgen examination. The diagnosis was substantiated in every instance. Five patients were re-examined after the bleeding had subsided and the presence of the lesion definitely confirmed. Four were proved at operation and 1 by gastroscopy. An important finding in 2 individuals of this group was the complete healing in seven to ten days of a superficial gastric ulcer which had been demonstrated at the initial examination, whereas subsequent re-examinations seven and ten days later revealed no evidence of the lesion (Fig. 7). Had the roentgen examination been deferred until the subsidence of the bleeding, the diagnosis in all probability would not have been established. These cases emphasized the fact that early roentgen study was an important factor in reducing the number of undiagnosed cases in patients with acute bleeding from the upper gastrointestinal tract. The use of small amounts of opaque material was essential for the demonstration of gastric ulcers. Even large

ulcerations were not always visualized on routine roentgenograms of the stomach, particularly if the stomach had been completely filled or the ulcer was in the posterior portion of the stomach. It was important to distribute the first swallow of barium over the entire gastric wall by gentle manipulation with the gloved hand in order to fill the small ulcer craters which otherwise might not have been demonstrable. Spot roentgenograms made during the roentgenoscopic observations were utilized regularly. Not infrequently small ulcerations were demonstrated at roentgenoscopy but could not be shown on the routine films made subsequently. It was our practice to use light palpation in all cases of suspected ulcer in order to outline the mucosa, to demonstrate the radiating folds which are characteristic of ulceration of the stomach, and to exclude the presence of a mass. It was helpful to observe the first swallow of the opaque meal as it entered the stomach since craters filled and were clearly visualized in some instances at this time only to be obscured when the stomach was more completely filled. Peristaltic activity was carefully observed since asymmetrical contractions or absence of peristalsis at the site of the lesion supplied the important clue to the diagnosis. The presence of an incisura, hour-glass deformity, or localized tenderness during roentgenoscopy indicated the presence of an ulcer and stressed the necessity for more complete study in order to demonstrate the lesion.

The diagnosis of duodenitis was made in 4 instances. The roentgen manifestations of duodenitis comprised intraluminal mottling, contracture of the duodenal cap due to spasm, irregularity of outline, and coarseness and thickening of the mucosa of the first portion of the duodenum. Spot

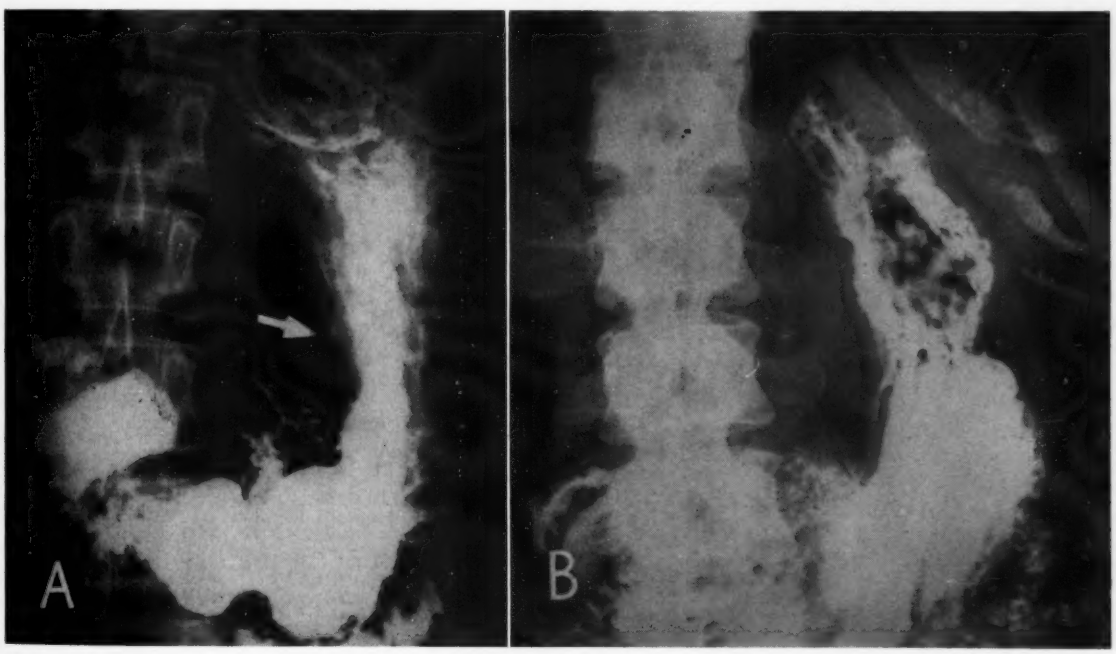

Fig. 7. *Small Gastric Ulcer with Healing in Ten Days.* (*A*) Roentgenogram immediately after admission to the hospital. There is a small projection from the lesser curvature aspect of the stomach in the region of the media (white arrow), a superficial gastric ulcer. The lesion was visualized both during roentgenoscopy and on routine roentgenograms. (*B*) Ten days later. The ulcer has healed completely and was not demonstrable during roentgenoscopy, on spot films, or routine roentgenograms.

This case emphasizes the importance of early roentgen study in patients with acute bleeding from the upper gastrointestinal tract. Small ulcers may heal rapidly. If the examination is delayed until the hemorrhage has subsided the lesion may not be demonstrable, resulting in failure to establish the diagnosis.

roentgenograms with pressure during roentgenoscopy were essential to demonstrate the changes. A small amount of barium meal was administered and observed carefully in its passage through the pylorus and duodenum. In most instances of duodenitis, the cap was irritable, contracted rapidly, and showed marked spasticity. Air contrast studies were obtained by turning the patient from the prone to the supine positions one or more times and were frequently useful in demonstrating the coarse, thickened mucosa, the superficial irregularities, and the small filling defects characteristic of duodenitis. Spot films during roentgenoscopy and overpenetrated routine roentgenograms proved helpful. As with gastritis, early carcinoma, small peptic ulcers and other lesions, overfilling of the stomach and duodenum prevented satisfactory demonstration of the changes essential to establish the diagnosis of duodenitis.

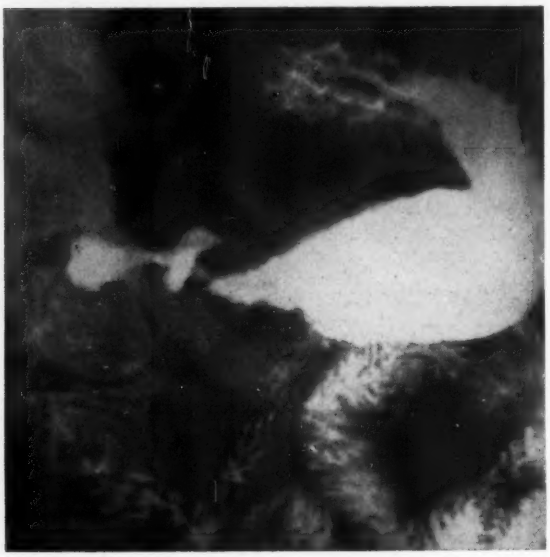

FIG. 8. *Duodenal Ulcer with Associated Gastritis.* The duodenal cap is contracted, constantly irregular in outline, and shows an ulcer crater formation. The gastric mucosa is coarse and thickened. There is narrowing and irregularity of the prepyloric portion of the stomach, which was proved to be due to gastritis.

Six patients in our series showed a diverticulum formation of the second portion of the duodenum. In 3 instances no other lesion which might account for the hemorrhage was found. Diverticulum formations were sometimes not visualized during the passage of the first swallows of barium through the pylorus and duodenum, only to fill at a later time. It was therefore essential to observe the duodenal loop throughout the roentgenoscopic examination and also after six hours to demonstrate the presence of retained opaque material in a diverticulum formation. The prone and anterior oblique positions were most satisfactory for visualization of the duodenal loop. No post-bulbar duodenal ulcers occurred in our series although the entire duodenum was carefully observed in every instance with this possibility in mind.

Twenty-two patients in the group studied by us were shown to have duodenal ulcer on roentgen study (Fig. 8). Three were operated upon and in each instance the diagnosis was confirmed. In 7 others re-examination at a later date showed the ulcer as at the previous study. Small ulcerations of the first portion of the duodenum were best visualized by spot roentgenograms made during roentgenoscopy (Fig. 9). The right anterior oblique and the left posterior oblique positions were most useful. Air contrast visualization of the duodenal bulb was obtained best with the patient lying on the left side and turned slightly posteriorly and was very important in demonstrating accumulations of barium in small ulcer craters. In some instances it was necessary to wait for a period of five, ten or more minutes until air from the gastric antrum had been forced into the duodenal bulb by peristaltic contractions. This afforded double contrast study of the duodenum and often proved helpful in showing small lesions which otherwise could not be visualized. Pressure studies, particularly with mechanical devices, were very helpful and were used whenever possible. In the large atonic type of duodenum small crater formations were often obscured when the duodenal cap was completely filled. Since the cap may appear smooth in outline when

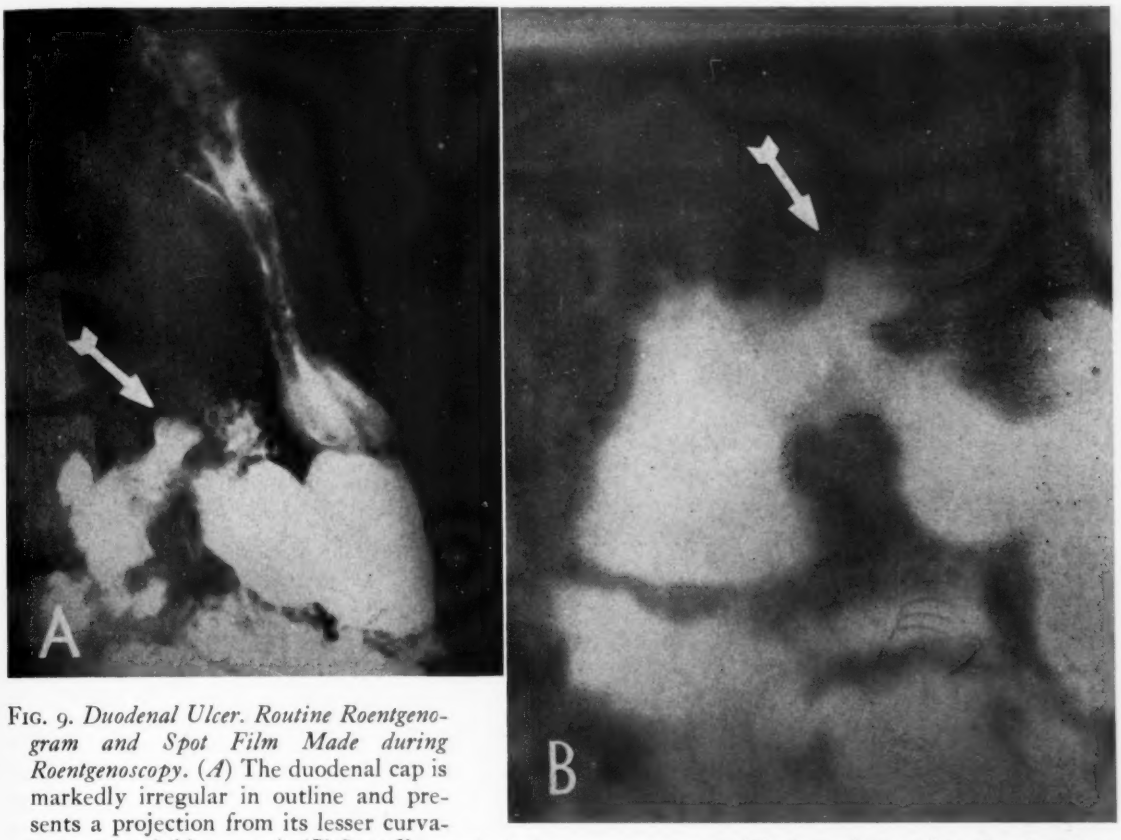

Fig. 9. *Duodenal Ulcer. Routine Roentgenogram and Spot Film Made during Roentgenoscopy.* (*A*) The duodenal cap is markedly irregular in outline and presents a projection from its lesser curvature aspect (white arrow). (*B*) Spot film made during roentgenoscopy. The irregularity of duodenal contour and the projection from the lesser curvature aspect of the cap are more clearly demonstrated (white arrow). A large duodenal ulcer was found at operation.

well distended and the presence of small ulcerations overlooked, it proved important to observe the duodenum after partial emptying had taken place and with compression.

Two patients in the series of 52 had had a gastroenterostomy. An ulcer in the region of the stoma was present in each case and was confirmed by endoscopy and at operation. In patients with gastrojejunostomy, it was essential that only a very small amount of the opaque material be administered, preferably one or two swallows comprising approximately 1 or 1½ ounces. Overfilling of the stomach was detrimental as it resulted in obscuration of important details. Pressure studies, particularly in the region of the anastomosis, and mucosal relief studies in various projections utilizing pressure and multiple spot films were helpful. If the patient had a gastroenterostomy without gastrectomy, the entire stomach and duodenum was studied since a gastric or duodenal lesion might be present despite a properly functioning gastroenterostomy. The afferent and efferent loops were observed carefully for the presence of lesions in these segments of the jejunum. When large amounts of barium were used, as sometimes became necessary to rule out esophageal varices, hiatus hernia, or lesions of the fundus of the stomach, roentgenoscopy and routine roentgenograms of the region of the stoma were first completed with the small amounts of barium. Subsequently an additional amount of barium was administered if necessary and the patient again roentgenoscoped in order to complete the examination.

Complications and Sequelae. In only 4 patients of the entire group was there a perceptible fall in blood pressure with elevation of the pulse after the roentgen examination. One vomited a moderate amount of red blood two hours after returning to the ward. Another passed red liquid stools throughout the day of the examination. A third showed a drop in hematocrit. We cannot state with certainty whether these patients had an exacerbation of the hemorrhage or were simply bleeding at the time of the studies and continued to do so afterwards. The cause of the bleeding and the extent of the roentgen examination in these patients is of interest. Two were operated upon within twelve hours after the roentgen examination and the roentgen findings were confirmed in both instances. One presented gastritis and the other gastritis and duodenitis. Both cases were examined with limited techniques excluding manipulation, palpation, or excessive movement. The third was diagnosed as a large ulcer of the lesser curvature aspect of the stomach and this was confirmed at operation. The fourth revealed a large ulcer in the prepyloric area. The latter 2 cases were studied in the recumbent and upright positions and pressure studies were utilized.

Our studies show that proper management of severe upper gastrointestinal bleeding requires close, constant cooperation between the clinician, esophagoscopist, radiologist and surgeon. Consultation between the members of this group is essential for proper correlation of all the facts and for evaluation of indications for and contraindications to emergency surgery. Early and complete roentgen study is a valuable adjunct in the management of patients with gastrointestinal hemorrhage and will result in a decrease in the number of undiagnosed cases.

SUMMARY AND CONCLUSIONS

Improvements in gastric surgery and the greatly lowered operative mortality rates in recent years emphasize the importance of early diagnosis in patients with acute upper gastrointestinal hemorrhage. Formerly any procedure which might increase the bleeding was carefully avoided during the acute phases and it was customary to defer roentgen examination until the bleeding had subsided. This at times entailed a delay of several days or longer and the roentgen ray was therefore greatly limited in its usefulness.

As part of a study of the combined medical, roentgenologic and surgical approach to the management of acute upper gastrointestinal bleeding, the accuracy and safety of early roentgen studies were investigated in a series of 52 patients. Emergency roentgen examination of the esophagus, stomach and duodenum was carried out as early as possible. Roentgen studies were performed in 42 per cent of the patients within twenty-four hours; in 63.5 per cent within forty-eight hours; and in approximately 83 per cent in less than seventy-two hours after admission to the hospital.

The roentgen studies were not performed in routine fashion but were individualized according to the condition of the patient. It was our practice to make the examination as complete and detailed as possible in order to obtain the maximum amount of information without endangering the patients. The patients were divided into three categories: those too ill to stand (3 patients); those able to stand but whose condition precluded the use of mechanical pressure (44 patients); and those in whom complete roentgen study including palpation and mechanical pressure was possible (5 patients).

Small amounts of the opaque meal proved more satisfactory for the demonstration of most lesions. The roentgen techniques are discussed.

Only 4 patients of the entire group showed evidence of continued or recurrent bleeding after the examination. In no instance were there any serious complications or sequelae attributable to the roentgen studies.

By careful correlation of the clinical data and consultation between the clinician and radiologist, roentgen examination of individuals with acute bleeding from the upper gastrointestinal tract may be made with a greater margin of safety in most instances than was formerly believed possible. The roentgenologist has an important place in the selection, management, and disposition of these cases. In our opinion, it is advisable not to defer the examination for as long a period as was considered necessary in the past.

Earlier roentgen study may prevent unnecessary laparotomy, reduce time-consuming exploratory procedures, and facilitate surgical therapy. It results in a decrease in the number of undiagnosed cases. The prompt determination of the cause of the hemorrhage and the localization of its site may in certain instances prove a life-saving procedure.

We wish to acknowledge the cooperation of and extend our sincere thanks to the many persons who participated in this study, in particular Dr. Franklin W. White, Dr. Charles S. Davidson, Dr. Thomas C. Chalmers, and the members of the contributing medical and surgical services at the Boston City Hospital. Also to Mrs. Audrey Durkee Whittem for assistance in compiling the data.

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REFERENCES

1. Bohrer, J. V. Massive gastric hemorrhage, with special reference to peptic ulcer. *Ann. Surg.*, 1941, *114*, 510–525.
2. Carter, M. G., and Zamcheck, N. Esophagoscopy in upper gastrointestinal bleeding. *New England J. Med.*, 1950, *242*, 280–283.
3. Eads, J. T. Massive gastrointestinal hemorrhage. *J.A.M.A.*, 1946, *131*, 891–893.
4. Hampton, A. O. Safe method for roentgen demonstration of bleeding duodenal ulcers. Am. J. Roentgenol. & Rad. Therapy, 1937, *38*, 565–579.
5. Heuer, G. J. Surgical aspects of hemorrhage from peptic ulcer. *New England J. Med.*, 1946, *235*, 777–783.
6. Hoerr, S. O., Dunphy, J. E., and Gray, S. J. Place in surgery in emergency treatment of acute massive upper gastrointestinal hemorrhage. *Surg., Gynec. & Obst.*, 1948, *87*, 338–342.
7. Jones, C. M. Diagnostic and therapeutic considerations of gastrointestinal bleeding. *New England J. Med.*, 1946, *235*, 773–776.
8. Kiefer, E. D. Jejunal ulcers and recurrent hemorrhages after partial and subtotal gastrectomy for peptic ulcer. *J.A.M.A.*, 1942, *120*, 819–824.
9. Kirklin, B. R., and Gilbertson, Eva L. Roentgenograms of thorax that suggest carcinoma of stomach. *J.A.M.A.*, 1947, *134*, 1228–1230.
10. Schatzki, R. Roentgenologic examination in patients with bleeding from gastrointestinal tract. *New England J. Med.*, 1946, *235*, 783–786.
11. Thorstad, M. J. Problem of bleeding peptic ulcer. *Surgery*, 1942, *12*, 964–981.
12. Warthin, T. A., Warren, R., and Wissing, E. G. Combined medical and surgical management of upper gastrointestinal hemorrhage. *New England J. Med.*, 1949, *241*, 473–478.
13. Zamcheck, N., Chalmers, T. C., White, F. W., and Davidson, C. S. Bromsulphalein test in early diagnosis of liver disease in gross upper gastrointestinal hemorrhage. *Gastroenterology*, 1950, *14*, 343–363.
14. Zamcheck, N., Cotter, T. P., Hershorn, S. E., Chalmers, T. C., Ritvo, M., and White, F. W. Early roentgen diagnosis in acute bleeding from upper gastrointestinal tract. I. Clinical evaluation of safety and reliability of method. *Am. J. Med.* In press.

DISCUSSION

Dr. Aubrey O. Hampton, Washington, D. C. I am glad to hear a paper confirming an old observation that I made a long time ago, and I would like to add my own experience of fourteen years.

There has been no contraindication for an early roentgen examination. I have convinced three different hospitals of this now. The clinicians are glad to cooperate. I have had 1 death on the roentgen-ray table; that was due to our own error. A colored boy who had bled for four days, in spite of all the blood they could give him, was about to die, and so he came to the roentgen department unconscious. We elected to insert a tube since he could not drink the barium. During the procedure we ruled out (we thought) a lesion of the stomach and duodenum, but we did not rule out varices of the esophagus, which he had and which probably were made worse by putting the tube down his esophagus.

I think Dr. Ritvo intentionally omitted to

say that the purpose of the examination is to find the posterior wall duodenal ulcer, which is by far the most common cause of hemorrhage. In my statistics recently I accumulated 222 ulcers and checked back through the records to determine the location as far as I was able to determine it; of that number, in cases of severe bleeding the ulcer was seven times as common on the posterior wall.

Bleeding ulcer is also a little different in location. It is placed distal to the average duodenal ulcer, at the apex of the duodenal cap. Some day I am hoping we will be able to tell by our observations whether or not this duodenal ulcer is likely to bleed, or is a severely bleeding type. That is, if the ulcer occupies the region of the pancreaticoduodenal artery, which it usually perforates into. Should we not warn the surgeon that this is a serious type of ulcer?

This is new to me. I have not been able to prove it even though I have been trying for fourteen years, because the pathologist does not give us adequate information on the location of the ulcer. He tells me that in order to localize a duodenal ulcer you have to have two clocks at right angles, and locate them by the clock. He is about right. You are locating something on a corkscrew, and that is not easy.

We talk glibly of posterior and anterior duodenal wall ulcers and lesser and greater curvatures, but it does not mean a thing to either the surgeon or the pathologist. The surgeon is likely to localize them to the medial aspect of the apex of the duodenal cap, and he will almost invariably say they are penetrating into the pancreaticoduodenal artery.

If we can help in these respects perhaps we can settle this argument about which case should be operated upon.

DR. RITVO (closing). Dr. Hampton's pioneer work in patients with acute bleeding from the upper gastrointestinal tract deserves great commendation. Prior to his studies, we had not considered it advisable to administer an opaque meal and perform fluoroscopic studies during the acute bleeding phases. In consequence, the valuable data afforded by the roentgen studies were not available to the clinician. Dr. Hampton's experience with the case of very severe bleeding due to varices of the esophagus might have been prevented by the use of the bromsulfalein test and esophagoscopy. This case emphasizes the importance of close cooperation between the clinician and the radiologist in the management of patients with acute bleeding from the upper gastrointestinal tract if unpleasant sequelae and, in some instances fatalities, are to be avoided. I wish to thank Dr. Hampton for his very kind comments.

Vol. 66, No. 5

SYMPTOMLESS PULMONARY ARTERIOVENOUS ANEURYSMS OR FISTULAS

By DOUGLAS J. ROBERTS, M.D., *and* J. ELDER HUTCHISON, M.D.
HARTFORD, CONNECTICUT

THE frequency with which pulmonary vascular abnormalities have been reported in the literature of late stimulates an awareness of a condition which probably is much more common than hitherto suspected. As Yater, Finnegan and Giffin[5] have indicated, these conditions probably all belong to the so-called heredofamilial angiomatosis (Rendu-Osler-Weber syndrome). While many cases lack the surface manifestations they described, about 1 in 4 of the recorded cases do show familial tendencies.

These aneurysms or fistulas, as some authors prefer to call them, have been reported under various titles such as cavernous hemangiomas, multiple pulmonary hemangiomas, arteriovenous fistula of the lung and congenital arteriovenous varix. As the gross anatomy consists of the same general formation, made up of a lobulated, thin-walled, branching, blood-filled, pulsating, pulmonary sac, with enlarged arterial and venous components, it seems appropriate to designate these changes under the name of pulmonary arteriovenous aneurysms which will tend to distinguish them from the more neoplastic forms of hemangiomas.

The earliest reported diagnosed case was by Rodes[4] in 1938, although earlier postmortem records have referred to this condition. Since then well over 40 cases have been sporadically reported in both our domestic as well as in the foreign literature, these largely stimulated by the great strides that thoracic surgery has made in the last decade.

The clinical features and the symptoms usually present make up a clinical syndrome which is characteristic of an arteriovenous shunt in the lungs, although, as Dr. Lerner of Boston has said in a recent publication, it is sometimes mistaken for congenital heart disease and polycythemia vera.

1. Patients are usually young. The oldest patient found recorded was fifty-six but most are between twenty and thirty, of either sex, with a normal heart and an obscure lung tumor roentgenologically, which may be on either or both sides, more commonly found in the lower lobes.

2. Cyanosis, which is variable in degree, has been present in all but one of the previously recorded cases. It is usually most pronounced in the mucous membranes of the mouth and conjunctiva. It has been estimated that about 30 per cent or more of the blood by volume must pass through the shunt to result in cyanosis.

3. Clubbing of the fingers and toes is present in nearly all of the cases reported.

4. Polycythemia is a constant finding, its degree being in direct proportion to the size of the fistula. The larger the volume of venous blood that leaves the right ventricle by-passing the pulmonary bed through the shunt, the larger the amount of unoxygenated blood returning to the left auricle, thus the low oxygen tension is the probable stimulus to the hematopoietic system causing the increase in the erythrocytes. Polycythemia vera can be excluded by the lack of corresponding elevation of the white blood cell count, also usually by the lack of associated splenic enlargement.

5. Symptoms of anoxia predominate, weakness, faintness, dizziness, and dyspnea, and occasionally chest pain and hemoptysis, but for the most part the symptoms are those secondary to polycythemia.

6. A continuous murmur has been heard over the tumors in about one-half of the cases reported.

Occasionally multiple hemangiomas may exist involving skin and lining of nose or mouth, with hemorrhage often the present-

FIG. 1. Note the small area of involvement beneath the right second rib toward the axilla.

ing symptom in the latter group. One author claims that as high as one-half the patients have hemangiomas elsewhere (Maier[3]).

The laboratory findings vary greatly, depending upon the volume of blood that is shunted from the pulmonary artery to the vein.

The red blood cell count has been reported as high as 11 million and the hemoglobin as high as 24 grams, but if no significant by-pass occurs in the aneurysm they may not be found abnormal. The arterial oxygen saturation is decreased when cyanosis is present. The cardiac output has been found rather uniformly normal which accounts for the general findings of no cardiac enlargement. The circulation time is usually normal but may be accelerated.

The roentgen findings are quite characteristic; rounded sinus areas of increased density are seen, which are as a rule continuous with the vascular markings, the hilus on the involved side appearing denser than the opposite due to the increased vascularity.

Stereoscopic films are needed but serial laminagrams made in right angle projections give more information on the direct association of these densities with the vascular tree. Films made in the Valsalva and Müller maneuvers may show the expansile character of the lesions, decreasing in size when the intrathoracic pressure is raised and enlarging when it is lowered. Pulsation may not be visualized in the dilated vessels without the use of kymography but rather invariably there will be noted roentgenoscopically an increased pulsation of the hilar structures on the side of involvement. Arterial catheterization for determination of changes in the components of the blood and for arteriography is, of course, a valuable procedure but not generally needed to establish the diagnosis. An exception to this is when operation is indicated. It would then seem advisable to routinely make an angiocardiogram because of the utmost importance of knowing the number and location of the lesions for assessment of the plan for surgical procedure.

CASE REPORT

E. V. W., female; American housewife, aged sixty-six, was admitted to the Hartford Hospi-

FIG. 2. The extreme basal portion of the lung is better visualized in the over-penetrated film of the abdomen.

tal May 25, 1948. She had had a roentgen examination of her chest one week previous to admission and the diagnosis of a metastatic nodule in the right lung had been made.

For one month she had been suffering from a severe intermittent pain in the right mid back and this pain was described as "a feeling as if someone was picking up nerves with forceps." This pain could be precipitated by flexing her spine, by sitting in a low chair or auto seat, or by pressure over the lower two ribs and the costovertebral angle on that side. It would disappear in the sitting or prone position or when pressure over the area was released. There were no other complaints except loss of appetite, easy fatigability, shortness of breath, and an awareness from remarks made by her family that she was "pale."

A review of her past history revealed that she had had a severe attack of pneumonia at the age of eight. Following that, aside from a normal number of mild upper respiratory infections and 5 normal pregnancies, she had not required medical attention until a hemorrhoidectomy at the age of fifty-one.

Physical examination at the age of fifty-seven showed no abnormality except a nodular thyroid, a soft apical systolic murmur, and a blood pressure of 200/110. Laboratory examinations showed a hemoglobin of 14 gm. per 100 cc., red blood cell count 5,500,000, white blood cell count 5,550. The differential white blood cell count was normal and the blood smear appeared normal. Studies of the chemical content of the blood revealed: non-protein nitrogen 35 mg. per 100 cc.; fasting blood sugar 93 mg. per 100 cc. A gastric analysis showed the presence of free hydrochloric acid. The basal metabolic rate was plus 2 per cent. A gastrointestinal roentgen examination showed no abnormality. There was no record of a roentgen study of her chest at that time.

Fig. 3. Lateral roentgenogram showing many of the dilated vessels obscured by the heart in Figure 1.

Fig. 4. Lateral laminagram.

Following this hospital study in 1938 she carried on her routine duties without complaints until the present illness.

Her family history is not remarkable except that one of her sons during the past year had shown signs of a spinal cord lesion. The spinal canal was explored by Dr. William Scoville at the Hartford Hospital and an arteriovenous aneurysm was found and successfully ligated, with relief of all symptoms and full recovery.

Physical examination at the time of her present admission showed the following positive findings which differed from the examination of ten years ago: an increase of 4 pounds in weight, blood pressure 180/90, an area about 4 inches in diameter at the right posterior axillary line over the lower ribs where a loud, harsh bruit was heard. This was very loud and harsh over a small area, and less loud and harsh

over a larger area and not changed in character by any change in position of the patient. The liver edge was felt two fingers breadth below the costal margin and was soft, not nodular, and not tender. The patient was afebrile. There was no evidence of cyanosis or clubbing of the fingers or toes.

The following laboratory results were recorded: hematocrit, 28; red blood cell count, 4,180,000; white blood cell count 6,750. The differential smear was normal except for hypochromia 2 plus, anisocytosis 2 plus, and poikilocytosis 1 plus. The platelets appeared normal in number. Blood sedimentation rate was 20 mm. in one hour (Westergren). Nonprotein nitrogen was 36 mg. per 100 cc.; uric acid 5.3 mg. per 100 cc.; bilirubin 0.3 mg. per 100 cc.; serum protein was 7.5 gm.; cephalin flocculation was negative in twenty-four hours and 1 plus in forty-eight hours. Circulation time (June 5, 1948) fluorescein arm to lip 10 sec. (normal 18 sec.); paraldehyde arm to lip 7 sec. (normal 10 to 15 sec.).

After admission the patient was given two blood transfusions of 500 cc. each and following these the hematocrit was 39.5 and the patient seemed to be relieved of all of her pain.

Roentgen findings showed a large, somewhat sacculated appearing density continuous with the hilar vessels in the right lower lobe with its larger portion towards the periphery. A similar, much smaller vascular enlargement was seen in the right subapical region well outward toward the axillary wall. No definite pulsations were seen in these opacities but the right hilar structures were observed roentgenoscopically to pulsate much more vigorously than the left. Calcification in a tortuous splenic artery was present.

The patient was discharged from the hospital after two weeks and remained symptom free for the following ten months when she reported a recurrence of the upper back pain and it was found that her physical examination was unchanged but her hematocrit was 28 and her red blood cell count 3,850,000. Following two transfusions of 500 cc. each her symptoms again disappeared.

Comment. The clinician in charge of the case has not considered it necessary to subject the patient to either angiocardiographic study or surgery up to this time in view of the mild symptoms; however, it is felt that continued observation is needed to note whether the multiple areas of involvement are truly stationary or if this represents an early stage that subsequently will show progressive changes. Is the recurring anemia in our patient perhaps due to a hidden hemangioma in the liver and are the lack of symptoms and signs in this instance due to the fact that we are dealing with more arterial than venous changes, which result in a minimal shunt?

SUMMARY

The literature on pulmonary arteriovenous aneurysms has been reviewed briefly. An unusual case of pulmonary vascular enlargements has been reported in an older age period than previously recorded, tending to show that arteriovenous aneurysms of the lung may exist without polycythemia or cyanosis but may be suspected on the basis of a murmur heard over the peripheral portion of the lung.

The roentgen appearance alone should indicate the diagnosis, especially when laminagraphic studies are made.

Angiography should be conclusive and probably should always be employed before submitting the patient to surgery, in order not to overlook smaller areas of involvement that may be shown by this procedure.

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REFERENCES

1. BOWERS, W. F. Rupture of visceral hemangioma as cause of death, with report of case of pulmonary hemangioma. *Nebraska M. J.*, 1936, *21*, 55–57.
2. CRANE, P., LERNER, H. H., and LAWRENCE, E. A. Syndrome of arteriovenous fistula of lung. AM. J. ROENTGENOL. & RAD. THERAPY, 1949, *62*, 418–431.
3. MAIER, H. C., *et al.* Arteriovenous fistula of lung. *J. Thoracic Surg.*, 1948, *17*, 13.
4. RODES, C. B. Cavernous hemangiomas of lung with secondary polycythemia. *J.A.M.A.*, 1938, *110*, 1914–1915.
5. YATER, W. M., FINNEGAN, J., and GIFFIN, H. M. Pulmonary arteriovenous fistula (varix). *J.A.M.A.*, 1949, *141*, 481–489.

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SUPRAHEPATIC INTERPOSITION OF THE COLON AND VOLVULUS OF THE CECUM*

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SUPRAHEPATIC interposition of the colon is a clinically rather unimportant condition, partly because of its rare occurrence, partly because it is generally considered to give no symptoms. As far as I know, the first author who stressed the importance of this condition in the study of the distribution of gas and fluid in the abdomen was Laurell.[5] He observed a patient with ascites and interposition of the colon and he emphasized the importance of a broadening of the lower thorax aperture as a causative factor, particularly in old men.

Kolju[4] deals with the condition in Tomsk, Siberia. A comparison of this study with the present material is of interest in the geographical distribution of the anomaly. This author suggests that interposition of the colon may cause dyspeptic symptoms. The material can, however, hardly be considered as conclusive concerning this problem.

Snell[6] found 3 cases among 2,035 mentally defective individuals presumably due to morphological abnormalities which are rather common in mentally defective individuals generally.

THE MATERIAL

The condition was found in 0.025 per cent of the roentgenograms in mass roentgen examinations of the chest. This frequency concerns the position of the colon at the moment of examination. It is not known how many of these cases belong to the permanent type. Kolju[4] found the anomaly in 0.14 per cent in 20,000 individuals, 14 of the 23 cases belonging to the permanent type.

The condition was observed in 64 males and 13 females. Also Kolju[4] found that males showed a greater predisposition to the anomaly. The average age of the males was seventy years, of the females fifty years. The difference is four times the standard error and shows that the condition tends to occur in older males and relatively younger females. The incidence in about 18,000 men above sixty-five years of age is 0.2 per cent against 0.02 per cent in 25,000 men between the ages, fifteen and sixty-five. The corresponding frequencies in women are 0.02 per cent and 0.006 per cent. Interposition thus increases more with age in men than in women.

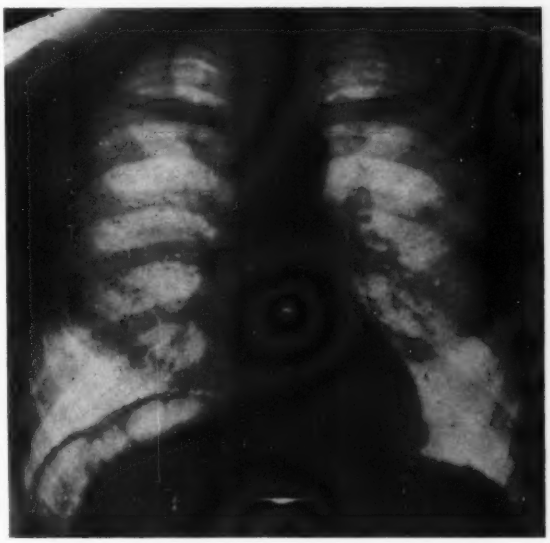

FIG. 1

The roentgenological appearance in men is typical (Fig. 1). In some cases the colon is found above the liver; in other cases it is placed to the right of the liver. The latter picture evidently represents an incipient stage of interposition, the former the final stage.

The same appearance may also be found in women, but in not a few cases in women

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Fig. 2

the colon is placed in front of the liver (Fig. 2). There is thus reason to distinguish between a male and a female form of interposition. The latter was found in 1 of the 64 cases in men, in 5 of the 13 cases in women.

In 1,000 patients from hospitals for psychotics the frequency was found to be 1 per cent. The average age of the 7 males and 4 females from such hospitals with the condition was forty-four years. In 500 mental defectives, most of them children, interposition of the right flexure was observed in 2 per cent. In other cases, an enormously dilated sigmoid was found displacing the liver downward and towards the midline, evidently rotating the organ around the craniocaudal axis. The appearance in some of these patients corresponds to the male form of interposition; most of the cases belong to the female form, however.

The parallelism between the age and sex distribution in interposition and in volvulus suggests a relation between these conditions. On the other hand, volvulus has never been recorded in individuals with interposition. To explain the basis of these contradictory observations, one has to consider the sex and age distribution in volvulus of different parts of the large intestine.

According to the information of Ö. Ödegaard, Chief of Gaustad Hospital for Psychotics, 35 deaths from ileus occurred among 3,360 deaths in patients in such hospitals in Norway in the years 1926–1940. The sex and age distribution in such patients is about the same as in the general population in individuals above fifteen years of age. According to a calculation on the basis of the official statistics, about 170 deaths from ileus occurred among 25,000 deaths in individuals above fifteen years of age in the population. The difference 0.36 $\pm$0.17 per cent indicates that deaths from ileus are relatively frequent in psychotics. A statistical analysis considering the numbers exposed to risk has been performed at the University Institute of Economics. The data do not prove that ileus is more frequent in psychotics. The prognosis may be worse in such patients for obvious reasons. On the other hand, the medical supervision, which is better in hospitals than in the general population, tends to decrease the death risk from ileus. It is reasonable to assume, therefore, that ileus, and possibly also volvulus, is frequent in psychotics, an assumption which is in agreement with clinical experience.

As known volvulus of the sigmoid is particularly frequent in old men, volvulus of the cecum, which is of particular interest in connection with interposition, occurs most frequently during the thirties (Frimann-Dahl[1]) and the ratio between men and women is equal (Jakobsen[3]). Volvulus of the cecum tends to occur in relatively young individuals and relatively often in women as contrasted with suprahepatic interposition of the colon.

Several conditions have been considered as causative factors in interposition, among them cirrhosis of the liver and relaxation of the diaphragm. The observations so far indicate that interposition is very rarely caused by pathologic processes. The low pressure in this region in expiration may be assumed to be of importance. Not infre-

quently the omentum may be interposed between the liver and diaphragm. Interposition of the colon is favored by meteorism tending to make the intestine light in relation to contents of the abdomen. If an interposition is going to develop at all, the cecum must be mobile with a free mesentery. One is impressed by the width of the lower thorax aperture in individuals with interposition. It is hardly possible to get exact measurements of the lower thorax aperture in mass roentgen examinations. However, the greatest breadth expressed in per cent of the length of the thorax illustrates the breadth of the lower thorax aperture in much the same way as the epigastric index expresses the relation between the breadth and the length of the epigastrium. The length may be measured along a perpendicular from the neck of the first rib to the greatest transverse diameter of the thorax. Such measurement in 20 cases of interposition and 20 comparable control cases confirmed the general impression of the width of the thorax in interposition. The broad lower thorax aperture in males tends to increase in breadth with age, particularly in the presence of a large amount of intra-abdominal fat or an emphysema of the lungs.

Fig. 3

Fig. 4

One case has been rather thoroughly examined and demonstrates the relation between interposition and the dynamics of the stomach and duodenum. In a male, aged fifty, the colon was found interposed to the right of the liver (Fig. 3). The ascending colon and cecum were displaced cranially, the appendix being situated at the level of the iliac crest. The interposition was intermittent. In the periods in which the colon was interposed, the ascending part of the duodenum was displaced upward and to the right by the pull of the pedicle of the mesocolon or the gastrocolic ligament. For this reason the emptying of the stomach was interfered with and the patient had rather severe symptoms of dilatation and insufficient emptying of the stomach. In the period in which the right flexure was in its proper place, the duodenum moved back towards the left and the emptying of the stomach was normal (Fig. 4).

It is of some interest that this patient had

two sisters, in one of whom a fixation of the cecum had to be performed due to intermittent attacks of acute abdominal pains which were considered to be due to volvulus of the cecum. In this family, interposition and volvulus of the cecum apparently behave as genetic equivalents. Another rather surprising finding was interposition in a man twenty-one years of age, by far the youngest man in the material, the brother of whom showed situs inversus of the viscera. This observation may of course be coincidental. However, the familial occurrence of situs inversus and incomplete rotation of the intestine, which conditions the coming into existence of interposition, is remarkable. Incomplete rotation of the mesentery, which in itself is an abnormality of symmetry, and visceral inversion show a high correlation in individual cases. If the influence of the genes were prominent in this condition, however, interposition in brothers and sisters would have to be expected in a few cases in a mass roentgen-ray series including about 90 per cent of the population in the regions examined.

DISCUSSION

The importance of the anatomy of the intestine and the mesentery in the pathogenesis of volvulus is well known from volvulus of the sigmoid and of the cecum. The anatomical peculiarities of the infant mesentery and the changes taking place with age and in variations of the fat content are essential to the understanding of these diseases.

In old men the broad upper part of the abdomen is favorable to a displacement of the mobile ascending colon laterally and upwards along the liver. The few cases of manifest interposition have to be taken as an indicator of a general tendency to lateral displacement in old men. In younger persons and in women the narrow thorax aperture does not permit such a displacement of the colon which is displaced medially as in the female form of interposition and in volvulus of the cecum.

According to the common opinion, the high frequency of volvulus in eastern Europe is due to meteorism because of the large amount of vegetables in the food in these countries. This factor is probably of importance. However, it is scarcely possible to exclude the influence of differences in the anatomy of the abdomen and the pelvis, and the lower thorax aperture.

The high frequency both of volvulus and interposition in psychotics and mental defectives may be due to the tendency to meteorism in such patients. The real problem is why these patients have a tendency to meteorism. Obstipation is said to be common in such individuals due to neglect of the bowels. The relation between the brain and the intestinal canal is mediated by pathways connecting the cortex and the hypothalamus. The abnormalities in the function of the intestines are not necessarily due to the mental disturbances. They are probably themselves expressions of an insufficiency of particular cortical functions. Fulton and Watts[2] produced invagination in apes by removing the frontal lobes, an observation indicating that the dynamics of the intestinal canal is regulated by the cortex.

The observations concerning the relation between intermittent interposition and the emptying of the stomach and duodenum are in accordance with previous observations concerning the influence of the mesentery on the cranial part of the intestinal canal. This relation is evident in duodenal obstruction in infants and in the varying shape of the stomach in adults.

The data show that the factors in interposition, such as age, sex, ethnic group and brain on the one hand, and the negative correlation to volvulus of the cecum, on the other hand, make this anomaly particularly suited to elucidate fundamental traits in the roentgenological and surgical anatomy of the abdomen.

SUMMARY

Suprahepatic interposition is relatively frequent in males. The frequency increases

with age. This increase is more pronounced in males. The anomaly shows a different roentgen appearance in the sexes, the colon being placed to the right and above the liver in men, in front of the liver in women in not a few cases. The incidence is probably relatively high in eastern Europe.

Interposition is particularly frequent in patients from hospitals for psychotics and mental defectives. Ileus and probably also volvulus is relatively frequent in such patients.

There is a negative correlation between interposition and volvulus of the cecum as far as the age and sex distribution is concerned. The tendency to interposition in older males apparently counteracts the tendency to volvulus of the cecum. The relatively broad lower thorax aperture is probably the cause of the frequent interposition in men.

Observations in a particular case demonstrate that interposition may produce disturbances in the dynamics of the stomach and duodenum.

Two cases are recorded suggesting a genetic relation between interposition, volvulus of the cecum and visceral asymmetry.

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REFERENCES

1. Frimann-Dahl, J. Roentgen examination of coecum volvulus. Avhandlinger utgitt av Det Norske Videnskaps-Akademi i Oslo. *Math. Naturv. Klasse*, 1943, *13*, 1–24.
2. Fulton and Watts. Cited by Fulton, J. F. Physiology of the Nervous System. Oxford University Press, p. 438.
3. Jakobsen, A. Volvulus caeci. *Acta chir. Scandinav.*, 1945, *92*, 99–212.
4. Kolju, K. J. Roentgen diagnosis of hepatodiaphragmatic interposition of large intestine. Am. J. Roentgenol. & Rad. Therapy, 1938, *39*, 928–936.
5. Laurell, H. Ueber die Lagerung von freier Flüssigkeit, Gas und beweglichen gasgeblähten Därmen in der Bauchhöhle. *Acta radiol.*, 1927, *8*, 109–119.
6. Snell, W. E. Radiographic abnormalities of stomach and colon in mental defectives. *Brit. J. Radiol.*, 1944, *17*, 239–240.
7. Torgersen, J. Genic factors in visceral asymmetry and in the development and pathologic changes of lungs, heart and abdominal organs. *Arch. Path.*, 1949, *47*, 566–593.

THE IMPORTANCE OF MINOR MYELOGRAPHIC DEFORMITIES IN THE DIAGNOSIS OF POSTERIOR PROTRUSION OF THE LUMBAR INTERVERTEBRAL DISC*

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DURING the last fifteen years myelography with opaque oil has become a routine examination in the diagnosis of posterior protrusion of the intervertebral disc. There has been a gradual evolution in its use from a purely diagnostic one to a preoperative study which confirms a clinical opinion and which reveals the exact level and possible multiplicity of disc protrusions. The clinical localization of the site of the lesion producing root pain is still unreliable, and the over-all error of this method has been variously reported from 25 per cent to 50 per cent in different series.[3,5,22,23] The accuracy and value of myelography are directly proportional to the care with which it is performed and to the skill with which it is interpreted. As a result of increased experience, the importance of the less prominent deviations from normal is gradually becoming apparent. Verification by surgical exploration has similarly become more precise. There can be no doubt that many laterally situated protruded intervertebral discs were not discovered in the earlier days when a transdural approach was employed.

The characteristic larger deformities produced by posterior protrusions or herniations are well known and will not be elaborated upon by us. The purpose of this paper is to describe and stress the importance of minor deformities of the subarachnoid space. This does not appear to have been done to any great extent in previous publications on this subject.

REVIEW OF LITERATURE

Many excellent investigations and statistical studies have appeared since the original contributions of Hampton and Robinson,[14] Mixter and Ayer,[17] and Mixter and Barr.[16] Few experienced authors other than Dandy have attempted to detract from the value of myelography.[1,6,11,23] Claims for accuracy in diagnosis and localization range as high as 93 per cent,[7,8,9,17,19] while the opposite extreme admits of overall error of from 25 to 35 per cent as summarized by Scoville *et al.*[20] The latter authors make an excellent differentiation between positive and negative errors. A negative error is one in which a posterior disc protrusion is found at operation following a "normal" myelogram. This is much more common than a negative exploration following a positive myelogram in reported series. Maltby and Pendergrass[15] have devoted an entire article to diagnostic mistakes made in myelography. It is well recognized that there are anatomical variations of the caudal sac which may prevent or make more difficult the direct demonstration of a disc protrusion,[1,4,5,13,14,21] but if this fact is appreciated, direct error can be avoided.[2,13] The importance of the minor root pouch deformities was first recognized by Hampton and Robinson, but few descriptions of these have appeared since then,[1,5,9,13,19,21] in spite of the fact that deformities of this type are frequent. Peacher and Robertson[19] reported pouch deformities in 49.3 per cent of abnormal myelograms. The occurrence of small midline protrusions has been described,[10,19] and also the appearance and significance of swelling of nerve roots.[4,14]

TECHNIQUE OF MYELOGRAPHY

Preliminary plain roentgenograms should

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always be made before myelography is undertaken. The anteroposterior view should include the hip joints, and if the lateral views show any suspicion of isthmus defects it is well to obtain oblique views. These routine films, although seldom diagnostic of disc protrusion, may reveal suggestive evidence of such a condition and they help to exclude other important lesions such as spondylolisthesis, hip joint disease, tuberculosis, malignancy, etc. At the Winnipeg General Hospital removal of a protruded intervertebral disc is rarely carried out without preoperative pantopaque myelography. If there has been a previous lumbar puncture, myelography should be deferred for at least ten days or two weeks, for otherwise deformities due to trauma from the needle or due to leakage of subarachnoid fluid into the subdural or extradural spaces may be encountered.

The necessary roentgenologic apparatus is relatively simple but it must include a tilting table, preferably motor-driven, and a spot film device. The personnel in our department consists of four individuals who are accustomed to working together. The roentgenologist is present during the entire procedure and maintains adaptation with red goggles. All roentgenographic exposures are made by him. The roentgen technician supervises setting the apparatus and also handles exposed and unexposed cassettes. A nurse sets up the sterile lumbar puncture tray. The fourth very important member of the team performs the lumbar puncture, injects the oil and later aspirates it. For some time a student roentgenologist, rather than an intern has been used in this capacity.

Only a light meal is permitted previous to the examination. If pain is severe, morphine is administered about thirty minutes beforehand. The patient is placed on the roentgen table in the prone position and a folded pillow is inserted under the abdomen to produce flexion of the lumbar spine. Soleless leather shoes are attached by straps to the footpiece of the table and laced around the ankles and feet.

Usually the lumbar puncture is carried out between L_3 and L_4 but if this proves impossible or if the preliminary films show much narrowing of this interspace, the needle is inserted between L_2 and L_3. We feel that puncture between L_4 and L_5 or between L_5 and S_1 is rarely advisable as these are the two regions where disc herniations are most common. The roentgenologist makes an ink mark on the back opposite the chosen interspace under roentgenoscopic control. Past experience has shown that unless this precaution is taken the puncture will often be made one interspace too high or too low. At the same time he carefully checks to see if there is any rotation of this portion of the spine. This is important, particularly when there is some rotoscoliosis, for under such circumstances external inspection may be quite unreliable. If necessary the patient is rotated to the right or left until the examiner is satisfied that rotation has been overcome.

An area of surrounding skin about 10 by 12 inches is then painted with iodine, following shaving if superfluous hair is present. At this stage of the procedure, it is usually advisable to explain to the patient the necessity of complete relaxation and it is often necessary to supplement these remarks with gentle pressure over the buttocks and lower chest to increase flexion. In the early days of myelography the patient was sometimes turned on the side to obtain a successful lumbar puncture, but more experience has shown that this is rarely necessary. After thorough infiltration with novocain, a No. 18 gauge lumbar puncture needle with a short bevel is inserted and directed as far caudally as possible, so that the point will come to lie slightly distal to, rather than directly over the underlying intervertebral disc. The normal disc itself often bulges somewhat posteriorly even though no posterior protrusion is present and, if the needle point is opposite this bulge, oil will not pool satisfactorily around it when aspiration is carried out later on. Deviation to the right or left is minimized by the radiologist who now stations himself at the head of the table and directs the progress of the needle so that it will parallel a vertical line painted on the opposite wall.

Before the dura is punctured, the needle and sterile skin are covered with a sterile gauze pad about 8 by 10 inches which is held in place by adhesive strips. The position of the needle is then checked by roentgenoscopy and if it does not seem to be directed centrally the necessary adjustments are made. When the alignment appears correct, the dura is punctured and when the needle is thought to be at the proper depth the stylet is withdrawn slowly to allow spinal fluid to escape. If there is no flow, the stylet is replaced and the needle point cautiously advanced. This is repeated until the puncture is successful, every effort being made to avoid injuring the

anterior wall of the canal. If the patient complains of "electric shocks" or pain radiating down one leg, it usually indicates that the needle is not central in position and that it should be withdrawn and properly reinserted.

As soon as a satisfactory puncture has been obtained, the head of the table is tilted up to about 30 degrees and 5 cc. of spinal fluid are collected. One-half cubic centimeter of opaque oil is then injected, the stylet reinserted, and the sterile gauze pad replaced. Without moving the table, the patient is roentgenoscoped to make certain that the oil has entered the subarachnoid space. If this is the case, it will usually have pooled below the needle opposite L5 or S1. Should there be any doubt, the table is raised or lowered to see if the oil moves readily. Roentgenoscopy at this stage is a most necessary step as, even though spinal fluid drips freely, the injected oil may have partly or wholly entered the subdural or the epidural space. In the event that it is all subarachnoid in location the remainder is injected, using a total of 6 cc. This amount can be aspirated just as completely as 3 cc., and we feel that the accuracy of diagnosis is greatly increased by the larger quantity. If the patient complains of discomfort during the latter part of the injection, roentgenoscopy should again be done to make certain that it is proceeding satisfactorily. If, on the other hand, the initial injection is seen to be unsatisfactory, it is immediately discontinued and a new puncture is made between L2 and L3. The first needle is left in place so that any deformity caused by it can be assessed when the films are interpreted.

When all the oil has been introduced the needle is again covered with the gauze pad. The head of the table is then lowered and the column of oil is observed as it passes cephalically as high as the domes of the diaphragms. Sometimes it is necessary to insert a second pillow under the pelvis to achieve this result, particularly if the thoracic posterior curvature is exaggerated. If any deformity is seen in the upper lumbar or lower thoracic regions, spot roentgenograms are made. Following this, the head of the table is raised slightly higher than the foot, and the pillow or pillows are removed. The table is then raised still farther until the patient is standing almost erect. When all the oil has collected in the most dependent portion of the subarachnoid space, the patient is repostured if necessary, so that the needle is again vertical to the table. Six spot roentgenograms are made routinely in the anteroposterior position, under roentgenoscopic control, even if nothing abnormal is seen. The first is with the patient nearly upright, and the others at intervals as the head is lowered so that by the time the final one is taken the head will be lower than the feet and the oil will usually be as high as L1 or L2. If it flows on or off a disc unevenly this is recorded. Then the head is again elevated and the patient rotated to one side about 40 degrees. Additional spot roentgenograms, ordinarily three in number, are made in this position. The first is with the table almost vertical, the second with some lowering of the head so that the oil column is centered opposite the disc between L4 and L5 and the third with more lowering of the head so that the column is centered over the disc between L3 and L4. This procedure is repeated with the patient rotated the *same* degree in the opposite oblique position. Thus, at least twelve spot roentgenograms are made whether or not any abnormality is visible under the roentgenoscope.

Frequently it is quite possible to diagnose a disc protrusion or herniation by roentgenoscopy, but a final diagnosis is never made until the films have been examined carefully. Roentgenoscopy is not prolonged in questionable cases as the spot roentgenograms can be studied at leisure without unnecessary exposure to the patient or operator and they show many minor deformities much more clearly than they can be seen under the roentgenoscope.

When the radiologist is satisfied that the examination is complete, the table is tilted so that the upper end of the oil column is just above the point of the needle. Occasionally it is necessary to re-insert the pillow under the abdomen to attain this objective. The stylet is now withdrawn gently, and aspiration commenced slowly without using too much negative pressure. The table is gradually tilted head down whenever spinal fluid begins to appear in the syringe and, when no further oil can be obtained, aspiration is discontinued. Usually it is possible to recover at least two-thirds of the oil at the first attempt. The table is again tilted so that the remaining oil collects around the needle point and the above procedure is repeated. In most cases all the oil can be removed after two or three such efforts. When aspiration is complete a final spot roentgenogram is taken for record purposes.

The oil gravitates toward the anterior part

of the spinal canal when the patient is in the horizontal prone position and particularly when the subarachnoid space is large there may be considerable subarachnoid fluid in the posterior part of the canal. Consequently if roentgenoscopy shows oil opposite the needle point and yet aspiration yields only cerebrospinal fluid, the needle must be inserted deeper. Should the column become broken up, it is well to run it all down into the lumbosacral region and then bring it up in one mass to the needle point. Occasionally after some of the oil has been aspirated the remainder does not pool well opposite the needle. Under such circumstances the upper end of the column should be collected just below the needle point and subsequent aspiration, while the head of the table is lowered, catches the oil as it flows upward past the needle. By repeating this precedure several times, it is usually possible to obtain a reasonably complete removal. Sometimes when aspiration is difficult, re-insertion of the pillow will solve the problem.

The size of the normal subarachnoid space varies tremendously. When it is wide, an off-center puncture is not necessarily a serious error but when it is narrow, a midline puncture is essential and even then aspiration may be difficult due to the small space between the nerve roots of the cauda equina. If aspiration causes pain it usually indicates that a nerve root is being sucked against the bevel of the needle. Re-insertion of the stylet and rotation of the needle may rectify this situation but, if this is unsuccessful, inserting it slightly deeper may produce the desired result. At all times, care must be taken not to traumatize the anterior wall of the canal, as this is apt to produce a hematoma which prevents satisfactory pooling.

If the point of the needle is to one side of the midline, the patient should be rotated by elevating the opposite side of the body, as this allows the oil to flow over into the desired portion of the canal. When serious difficulty in aspiration occurs, it is usually advisable to repuncture at another level before too much time has been wasted. As the examination has been completed, it is permissible to use the interspace between L4 and L5 or between L5 and S1 for by now any serious narrowing of the subarachnoid space at either of these two levels is known and can be avoided.

The extra time that is taken at the beginning of the examination by inserting the needle under roentgenoscopic control more than justifies itself in speed and ease of aspiration. Most myelograms done with this technique take no more than twenty to thirty minutes.

CASE REPORTS

Case I. Mrs. B. L. (Hosp. No. 16263/47). The entrance complaints were low back pain extending down the side of the right leg to the heel for three months. Lasègue's sign was negative. Myelography showed partial obliteration of the axillary pouch on the right side opposite the disc between L4 and L5. The subarachnoid space opposite the disc between L5 and S1 was narrow and it was felt that an abnormality of this disc could be neither diagnosed nor excluded completely (Fig. 1). Operation performed on December 12, 1947, revealed no abnormality of the disc between L5 and S1. A moderate sized posterior protrusion of the right side of the disc between L4 and L5 was removed. She was last seen ten months later at which time she was doing her own housework. Her back was not painful but she had an occasional pain down her leg.

Case II. Mr. H. D. (Hosp. No. 3963/47). For two years there had been low back pain and for four months there had been increasingly severe pain and numbness in the right hip and the lateral aspect of the right leg to the calf. Myelography revealed a small anterolateral defect on the right side opposite the disc between L4 and L5. There was compression of the pouch above this and a swollen nerve root was visible opposite the body of L4. The subarachnoid space was very short so that an abnormality of the disc between L5 and S1 could not be ruled out (Fig. 2). At operation on March 24, 1947, no abnormality of the disc between L5 and S1 was found. A moderate sized posterior protrusion of the right side of the disc between L4 and L5 was removed. He was last seen two and a half years later when he was symptom free.

Case III. Mrs. E. H. (Hosp. No. 4934/48). This patient had suffered from pain extending down the back of the left leg almost as far as the ankle for four months. Lasègue's sign was positive. Myelography showed slight elevation and widening of the pouch on the left side opposite the disc between L5 and S1 when the patient was upright. This became less marked when the oil was moved cephalically (Fig. 3).

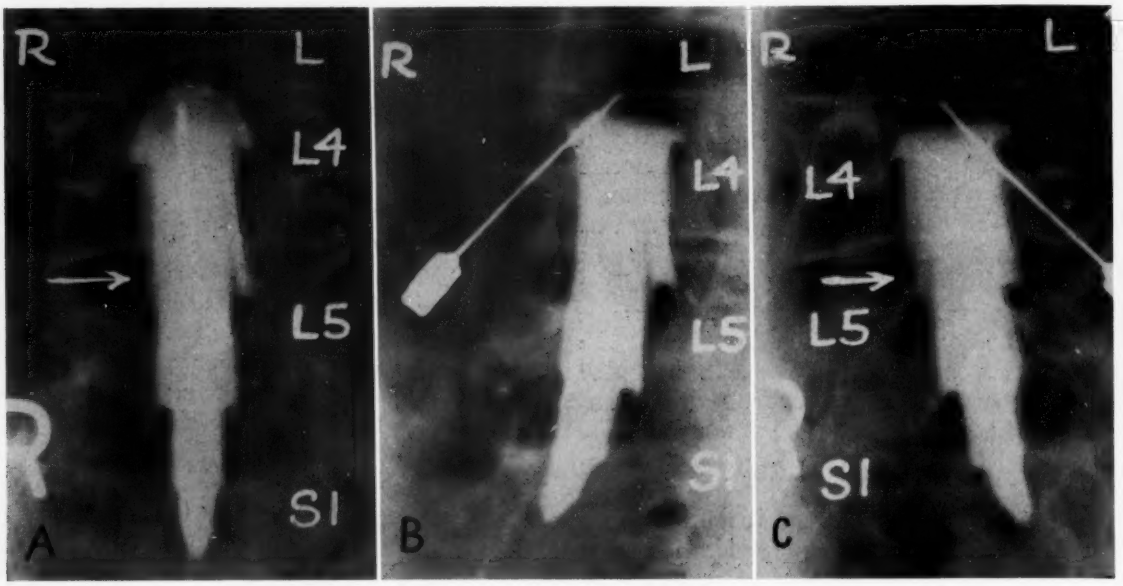

FIG. 1. Case I. The posteroanterior (*A*) and oblique (*C*) views show partial obliteration of the axillary pouch on the right side opposite the disc between L4 and L5. There is no appreciable indentation of the main column of oil. At subsequent operation an average sized posterior protrusion of the adjacent disc was removed.

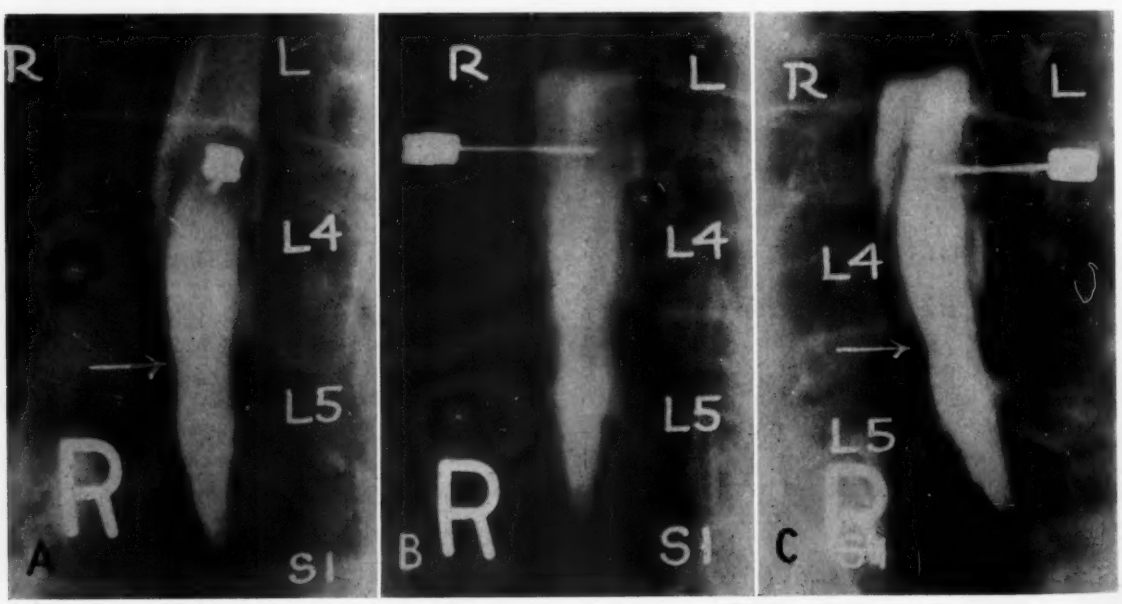

FIG. 2. Case II. There is a small anterolateral indentation on the right side opposite the disc between L4 and L5 (*A*) and (*C*). The axillary pouch above this disc is obliterated and a swollen nerve root can be seen extending upward on the right side opposite the body of L4 and opposite the disc between L3 and L4. An average sized posterior protrusion of the right side of this disc was found at operation.

Oblique views confirmed the left-sided deformity. Operation on April 21, 1948, revealed a small protrusion of the disc between L5 and S1 on the left. A check-up one year later revealed only occasional pain in the back and leg. The patient was sufficiently pleased with the result that she said she would be willing to have another operation if her symptoms recurred.

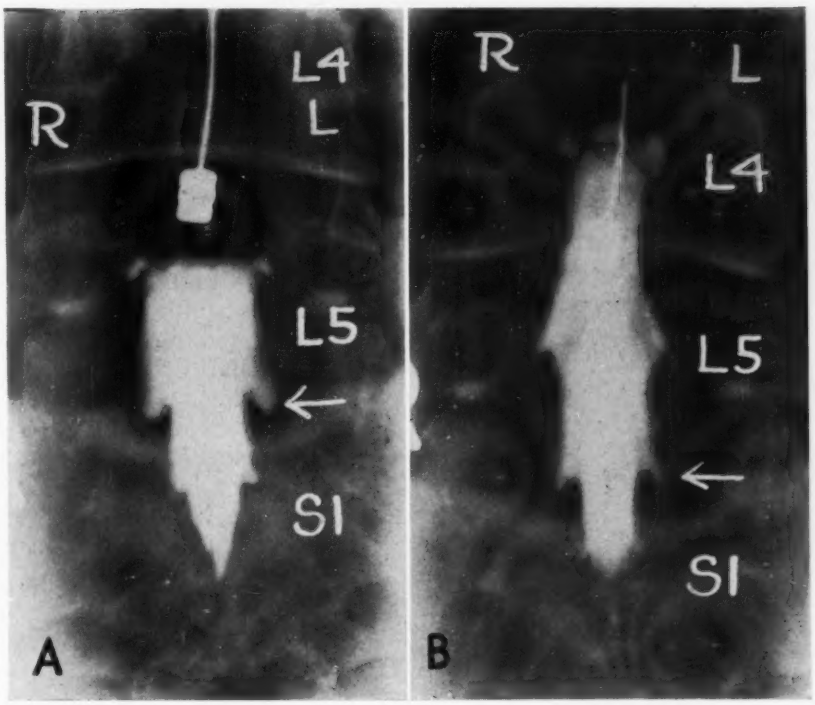

Fig. 3. Case III. With the patient almost vertical there is slight elevation and some broadening of the axillary pouch on the left side opposite the disc between L5 and S1, and the lateral margin of the subarachnoid space distal to this is slightly concave (*A*). The deformity on the left becomes less obvious when a more horizontal position is assumed (*B*). Oblique views confirmed the left-sided deformity. Operation revealed a small posterior protrusion of the left side of this disc.

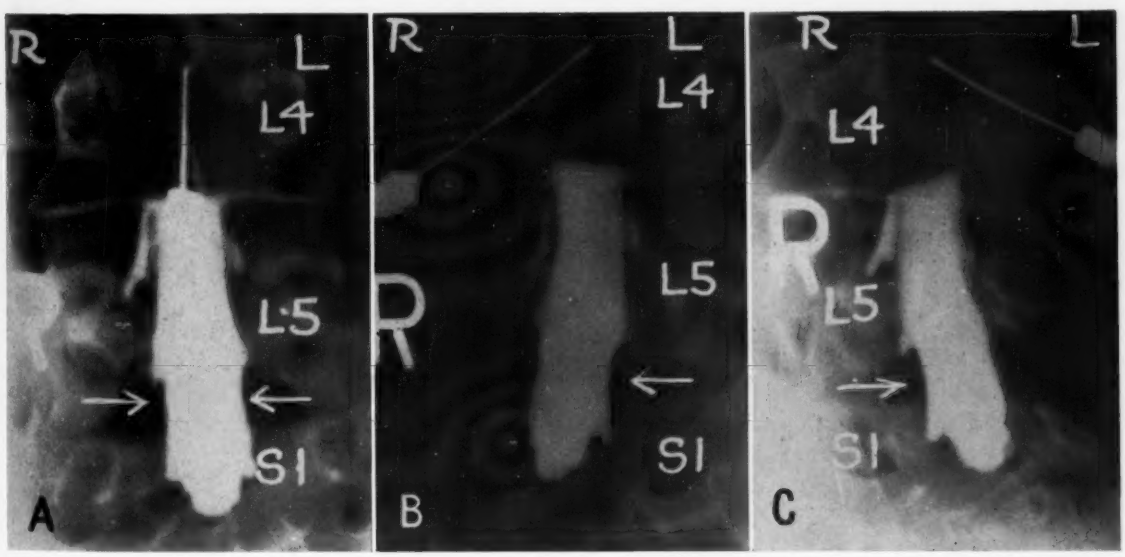

Fig. 4. Case IV. The oblique views (*B*) and (*C*) show anterolateral compression of the subarachnoid space on both sides opposite the disc between L5 and S1. The axillary pouch on the left side is shortened and almost obliterated (*A*) and (*B*). A moderate sized midline type of posterior protrusion was found at operation.

CASE IV. Miss L. B. (Hosp. No. 15458/47). The patient fell from a horse, wrenching her left hip, about four months previously. Since then there had been pain in the back extending down the lateral side of the right leg to the outer side of the foot. Myelography revealed almost complete obliteration of the axillary pouch on the left side opposite the disc between L5 and S1, as well as bilateral anterolateral indentations of the subarachnoid space at this level (Fig. 4). On November 22, 1947, a moderate sized midline posterior protrusion of the disc between L5 and S1 was removed. No follow-up is available.

CASE VII. Mrs. A. J. (Hosp. No. 5483/48). This patient had suffered from backache for many years. For ten months there had also been pain radiating into the posterior portion of the right thigh. This pain was intermittent, although quite severe at times. Myelography revealed slight lateral displacement of the axillary pouch on the right side opposite the disc between L5 and S1. The oblique view also showed an anterolateral indentation caudal to this pouch (Fig. 7). Operation on May 5, 1948, uncovered a large posterior protrusion of the right side of the disc between L5 and S1. She was last heard from two years later when she stated that although she still had some back pain, the pain in the leg was infrequent and did not limit her activities.

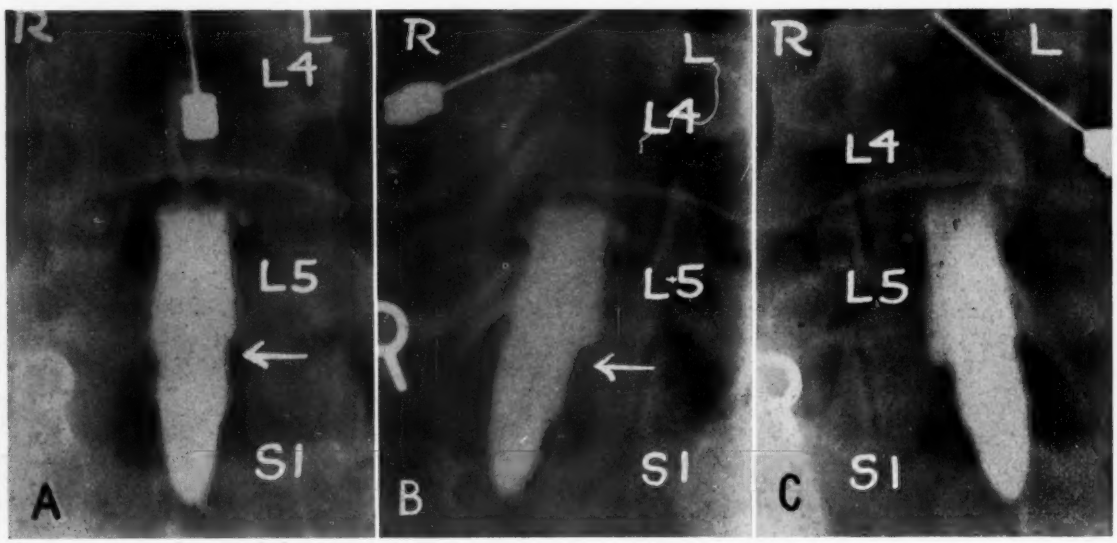

FIG. 5. Case v. There is elevation and slight shortening of the axillary pouch on the left side opposite the upper portion of the disc between L5 and S1 (*A*) and (*B*). The anterolateral margin of the subarachnoid space distal to this on the left side is straight rather than slightly convex. Operation revealed a large left-sided posterior protrusion of this disc.

CASE V. Mr. C. Z. (Hosp. No. 13036/47). There was a history of low back pain and pain extending down the back of the left leg to the ankle for four months. Lasègue's sign was positive on the left side. Myelography revealed slight shortening and elevation of the axillary pouch on the left side opposite the disc between L5 and S1 (Fig. 5). Operation on September 30, 1947, showed a large posterior protrusion of the left side of the disc between L5 and S1. He reports a complete cure, being free of complaints two and one-half years later.

CASE VI. Miss V. D. (Hosp. No. 11835/47). For four months there had been low back pain as well as pain extending down the back of the right leg to the ankle. Lasègue's sign was positive on the right. Myelography revealed slight shortening and compression of the axillary pouch on the right side opposite the disc between L5 and S1, more obvious in the oblique view (Fig. 6). At operation on August 30, 1947, a small posterior protrusion of the disc between L5 and S1 on the right was removed. Patient was last seen two years later and although improved she still complained of some back and leg pain. She is an unstable type and she stated she would not have another operation if her original symptoms recurred.

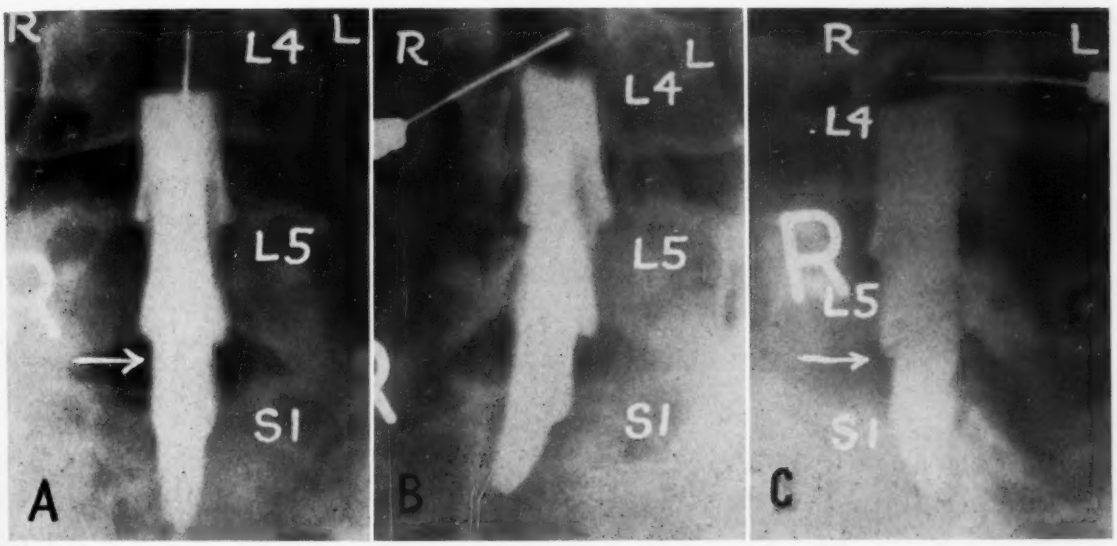

Fig. 6. Case vi. The anteroposterior view (*A*) shows only slight shortening of the axillary pouch on the right side opposite the disc between L5 and S1. Shortening and compression are quite evident in the oblique view (*C*). A small posterior protrusion of the right side of this disc was found at operation.

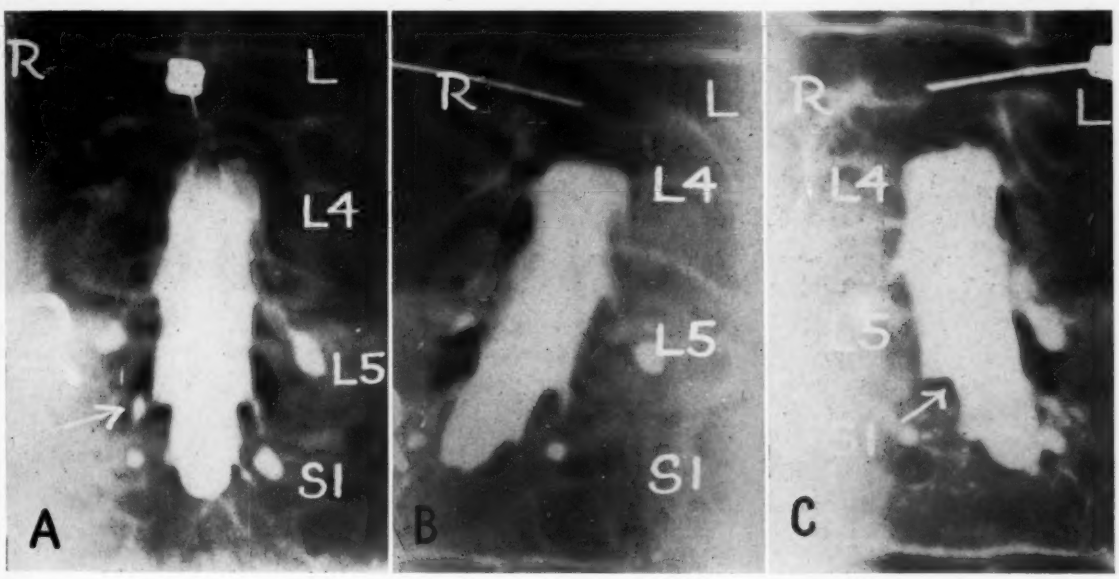

Fig. 7. Case vii. There is slight lateral displacement of the axillary pouch on the right side opposite the disc between L5 and S1 in the anteroposterior view (*A*). The oblique view (*C*) shows a localized anterolateral defect just caudal to this pouch and it also reveals much more deformity of the pouch. At operation a large posterior protrusion of the right side of this disc was removed.

Case viii. Mr. J. E. (Hosp. No. 8991/48). For seven months this patient had suffered from pain in the low back and pain extending down the back of the left leg to the ankle. In the two weeks prior to admission, there had also been pain down the medial side of the right leg to the knee. A myelogram showed very little deformity in the anteroposterior projection but well marked anterolateral indentation in the oblique view opposite the left side of the disc between L5 and S1 (Fig. 8). Operation was performed on July 28, 1948, and a large

posterior protrusion of the disc between L5 and S1 was removed. Patient was seen about one year later and had no complaints except for some slight back pain.

CASE IX. Mr. B. McM. (Hosp. No. 12551/48). For one month there had been pain in the low back extending down the back of the left leg to the ankle. Myelography revealed slight anterolateral indentation of the left side of the large posterior extrusion of the right side of the disc between L5 and S1. Patient was last seen eighteen months later when he was feeling well with only occasional back and leg pain. He was very much pleased with the result.

DISCUSSION

The cases reported above were not chosen primarily to illustrate good postoperative

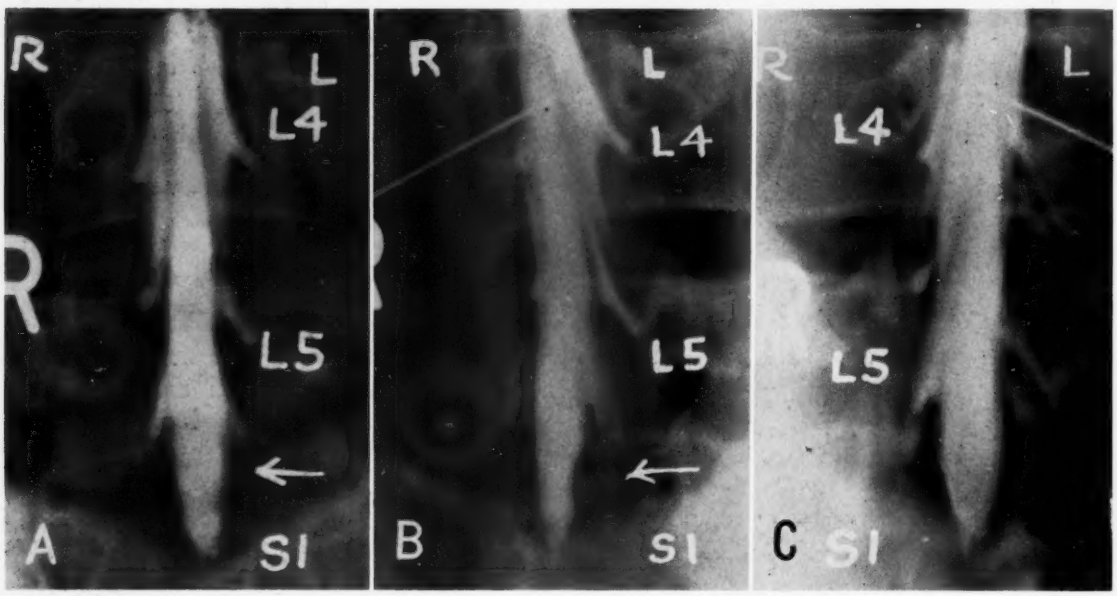

FIG. 8. Case VIII. The anteroposterior view (*A*) reveals only minimal deformity, but the oblique view (*B*) shows a well defined anterolateral indentation of the subarachnoid space on the left side opposite the disc between L5 and S1, and shortening of the adjacent axillary pouch. A large left posterior protrusion of the fifth disc was later removed.

subarachnoid space opposite the disc between L5 and S1 (Fig. 9). At operation a large posterior protrusion of the left side of the disc was removed. Patient was seen about two months after operation and was quite well. Friends report more recently that he has had an excellent result.

CASE X. Mr. W. L. (Hosp. No. 14175/47). For years this patient had suffered from low back pain. About six weeks before admission it became worse and he developed pain radiating down the lateral side of the right leg to the foot. Myelography showed no definite deformity (Fig. 10). The subarachnoid space was very narrow and consequently the surgeon was advised that a disc protrusion could not be ruled out. Subsequent operation uncovered a

results but rather as typical examples of the types of minor deformity which we feel to be important in the diagnosis of posterior protrusion of the intervertebral disc. Disc protrusions were removed at subsequent operation and in almost half the cases these were found to be large in spite of the comparatively small deformity. In most instances the subsequent course has been quite satisfactory.

Interpretation of myelograms should never be attempted without full knowledge of the clinical complaints and findings, for it seems certain that many disc protrusions cause few if any serious symptoms. On the other hand, if the patient complains of

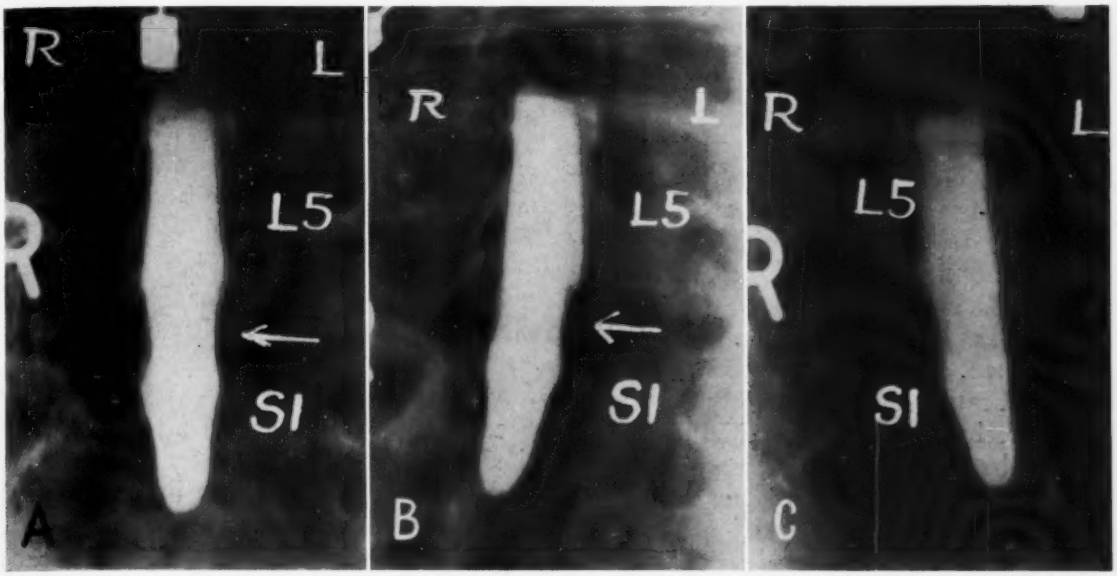

Fig. 9. Case IX. There is a minor anterolateral and lateral indentation of the subarachnoid space on the left side opposite the disc between L5 and S1 (*A*) and (*B*). In this individual the axillary pouches are quite inconspicuous, evidently due to an anatomic variation. Operation revealed a large posterior protrusion of this disc on the left side.

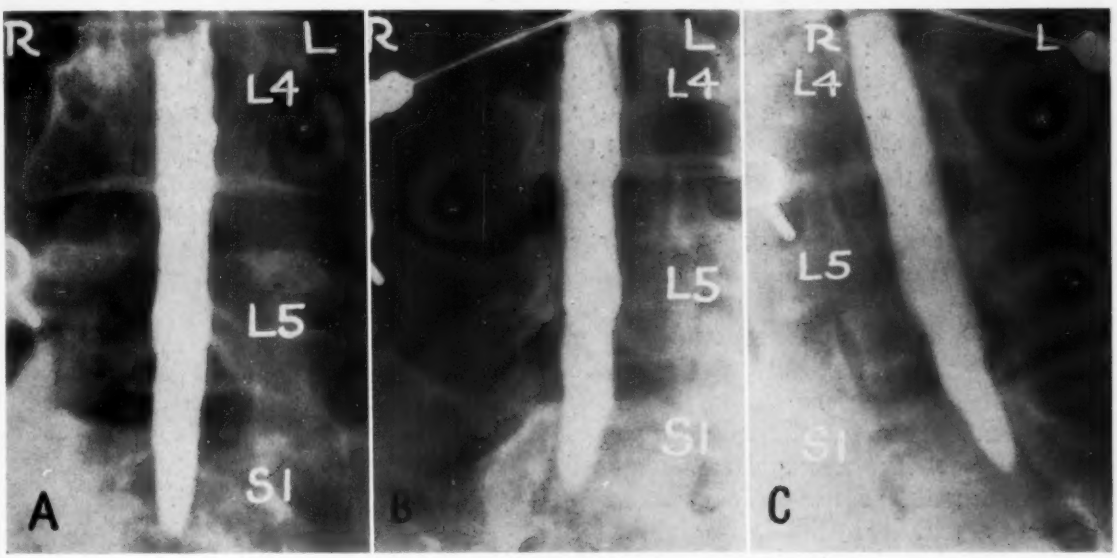

Fig. 10. Case X. An example of a very narrow subarachnoid space in which no definite deformity is shown, in spite of the fact that operation disclosed a large posterior protrusion of the right side of the disc between L5 and S1. With this type of subarachnoid space no attempt should be made to exclude posterior disc protrusion at the fifth interspace by myelography even though no definite deformity is shown.

radiating pain into the sacroiliac region, hip or down the leg and there is any suggestion of a deformed pouch, anterolateral flattening or concavity of the subarachnoid space on the same side, it has been our practice for the last seven or eight years to call attention to this. Not all patients with such findings have come to operation but clinically important disc protrusions have almost invariably been found when exploration has been carried out.

Minor deformities are much more com-

monly encountered opposite the disc between L5 and S1 than they are above this level. Even a large posterior protrusion of this disc may produce minimal deformity and if the subarachnoid space is narrow and the axillary pouches small, there may be no deformity at all (Case x). With this type of space it must be realized that disc protrusion cannot be excluded and if the signs and symptoms suggest such a lesion the radiologist should not advise against exploration.

The location of a posteriorly protruded intervertebral disc has considerable bearing on the myelographic picture. The more laterally situated ones, in general, produce the smallest deformities, particularly when the pouches are not well developed. Normally the anterolateral margin of the subarachnoid space distal to a pouch is slightly convex laterally. Concavity or even straightness of the margin may be most significant. Lateral displacement of an axillary pouch is sometimes encountered (Case VII) and this indicates a medially situated protrusion. At times the deformity is more evident when the main column of oil is opposite the disc (Case III) and at other times the reverse is true.

Many of these minor deformities are difficult or even impossible to recognize under the roentgenoscope. For this reason a complete series of at least twelve spot roentgenograms should always be made whether or not any abnormality is seen on the screen. By keeping the aperture small, radiation to the patient and radiologist is minimized and the necessity of using a stationary grid is avoided. It should be emphasized that oblique views are essential and often confirm the presence of deformities which otherwise would be doubtful or completely overlooked (Cases V, VI, VII, VIII and IX). We do not advocate the routine use of lateral views in the study of the disc problem although they are useful in the diagnosis of tumors.

It is felt that myelography may well fall into considerable disrepute if only the well recognized larger deformities are considered significant. Unless smaller, less evident abnormalities are noted and considered to be at least suggestive of posterior protrusion of an intervertebral disc, the percentage of "negative" errors will remain relatively high.

SUMMARY

1. An appreciable number of posterior protrusions of the lumbar intervertebral discs, particularly those between L5 and S1, produce only minor myelographic deformities.

2. When interpreted in conjunction with the clinical history and physical findings such minor deformities are important and should not be ignored.

3. Many of these small deformities cannot be seen roentgenoscopically and consequently a routine series of at least twelve spot roentgenograms should always be made when myelography is undertaken. Oblique views must not be omitted.

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REFERENCES

1. ALEXANDER, G. L. Prolapsed intervertebral disc. *Edinburgh M. J.*, 1947, *54*, 14–29.
2. ARBUCKLE, R. K., SHELDEN, C. H., and PUDENZ, R. H. Pantopaque myelography; correlation of roentgenologic and neurologic findings. *Radiology*, 1945, *45*, 356–369.
3. BARR, J. S. Ruptured intervertebral disc and sciatic pain. *J. Bone & Joint Surg.*, 1947, *29*, 429–437.
4. BEGG, A. C., FALCONER, M. A., and MCGEORGE, M. Myelography in lumbar intervertebral disk lesions; correlation with operative findings. *Brit. J. Surg.*, 1946, *34*, 141–157.
5. BRADFORD, F. K., and SPURLING, R. G. The Intervertebral Disc with Special Reference to Rupture of the Annulus Fibrosus with Herniation of the Nucleus Pulposus. Second edition. Charles C Thomas, Publisher, Springfield, Ill., 1945.
6. BURNS, B. H., and YOUNG, R. H. Protrusion of intervertebral disk. *Lancet*, 1945, *2*, 424–427.
7. CAMP, J. D. Multiple tumors within spinal canal;

diagnosis by means of lipiodol injected into subarachnoid space (myelography). Am. J. Roentgenol. & Rad. Therapy, 1936, *36*, 775–781.

8. Chamberlain, W. E., and Young, B. R. Diagnosis of intervertebral disk protrusion by intraspinal injection of air; myelography. *J.A.M.A.*, 1939, *113*, 2022–2024.
9. Childe, A. E. Role of x-ray in diagnosis of posterior herniation of intervertebral disc. *Canad. M.A.J.*, 1945, *52*, 458–470.
10. Copleman, B. Roentgenographic diagnosis of small central protruded intervertebral disc, including discussion of use of pantopaque as myelographic medium. Am. J. Roentgenol. & Rad. Therapy, 1944, *52*, 245–252.
11. Dandy, W. E. Concealed ruptured intervertebral disks; plea for elimination of contrast mediums in diagnosis. *J.A.M.A.*, 1941, *117*, 821–823.
12. Echlin, F. A., Selverstone, B., and Scribner, W. E. Bilateral and multiple ruptured discs as one cause of persistent symptoms following operation for herniated disc. *Surg., Gynec. & Obst.*, 1946, *83*, 485–493.
13. Falconer, M. A., McGeorge, M., and Begg, A. C. Observations on cause and mechanism of symptom-production in sciatica and low-back pain. *J. Neurol., Neurosurg. & Psychiat.*, 1948, *11*, 13–26.
14. Hampton, A. O., and Robinson, J. M. Roentgenographic demonstration of rupture of intervertebral disc into spinal canal after injection of lipiodol. Am. J. Roentgenol. & Rad. Therapy, 1936, *36*, 782–803.
15. Maltby, G. L., and Pendergrass, R. C. Pantopaque myelography; diagnostic errors and review of cases. *Radiology*, 1946, *47*, 35–46.
16. Mixter, W. J., and Barr, J. S. Rupture of intervertebral disc with involvement of spinal canal. *New England J. Med.*, 1934, *211*, 210–215.
17. Mixter, W. J., and Ayer, J. B. Herniation or rupture of intervertebral disc into spinal canal. *New England J. Med.*, 1935, *213*, 385–393.
18. Nosik, W. A. Intraspinal thorotrast. Am. J. Roentgenol. & Rad. Therapy, 1943, *49*, 214–218.
19. Peacher, W. G., and Robertson, R. C. L. Pantopaque myelography; results, comparison of contrast media, and spinal fluid reaction. *J. Neurosurg.*, 1945, *2*, 220–231.
20. Scoville, W. B., Moretz, W. H., and Hankins, W. D. Discrepancies in myelography; statistical survey of 200 operative cases undergoing pantopaque myelography. *Surg., Gynec. & Obst.*, 1948, *86*, 559–564.
21. Soule, A. B., Jr., Gross, S. W., and Irving, J. G. Myelography by use of pantopaque in diagnosis of herniations of intervertebral discs. Am. J. Roentgenol. & Rad. Therapy, 1945, *53*, 319–340.
22. Spurling, R. G., and Thompson, T. C. Notes on diagnosis of herniated nucleus pulposus in lower lumbar region. *Surgery*, 1944, *15*, 387–401.
23. Young, R. H. Protrusion of intervertebral discs. *Proc. Roy. Soc. Med.*, 1947, *40*, 233–236.

A PRELIMINARY REPORT ON TELEPAQUE, A NEW CHOLECYSTOGRAPHIC MEDIUM

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THE introduction of cholecystography in 1924 by Graham and Cole[5] constituted a major advance in the diagnosis of gallbladder disease. Despite its value, the technique presented certain disadvantages. As originally advocated, it required intravenous injection of the cholecystographic medium. This made the examination a cumbersome and time-consuming procedure. Within a short period of time, however, other investigators had demonstrated satisfactory visualization of the gallbladder after oral administration of the medium.[11] While this eliminated a major problem, there were still others. The most important of these was a distressing number of unpleasant and occasionally a serious side reaction following ingestion of tetraiodophenolphthalein. Diarrhea, nausea and vomiting occurred in a very high percentage of cases; and shock, because of severe diarrhea, was by no means uncommon. Elimination of impurities and contaminants from the drug decreased the incidence and severity of the untoward reactions, but they were still a major problem.

Priodax, or biliselectan, introduced in 1940, was clearly superior to tetraiodophenolphthalein, and soon became the standard gallbladder medium.[8] It provided satisfactory visualization of the gallbladder in a majority of cases. Fewer undesirable sequelae followed its use, and serious toxicity was rare. Nevertheless, a majority of the patients still showed untoward symptoms. The published series give figures varying from 45 per cent to 90 per cent of patients showing undesirable reactions.[1,3,4,6,10,12,13,14,15] Although very few were of major severity, their occurrence was objectionable, and prompted the search for more satisfactory materials. The following is a report of a brief clinical trial of a new cholecystographic medium, telepaque.‡

MATERIALS

Telepaque, the subject of the present investigation, represents an attempt to synthesize a material showing the following characteristics:

1. Selective localization within the gallbladder.
2. Sufficient content of material of high atomic number to insure roentgenologic visualization.
3. Low level of systemic toxicity.
4. Non-irritating to mucosal surfaces.
5. Satisfactory results on oral administration.
6. Prompt and easy elimination.

In common with other cholecystographic media, this material consists of an iodine substituted organic compound. The organic radical is of such a type as to insure absorption and concentration in the gallbladder. The iodine provides radiopacity because of its high atomic number. The chemical formula is as follows: 3-(3-amino-2,4,6,-triiodophenyl)-2-ethylpropanoic acid. In contrast with iodoalphionic acid (priodax) which contains 51.38 per cent iodine, telepaque contains 66.68 per cent of this element. Its radiopacity is correspondingly increased.

Pharmacologic studies in dogs have shown no hepatic or renal impairment after total doses as high as 500 mg. per kilogram.[9] Further investigations indicate an LD_{50} greater than 12,600 mg. per kilogram on oral administration to mice.[7] Comparatively speaking, these amounts far exceed the usual clinic dose of 3 grams.

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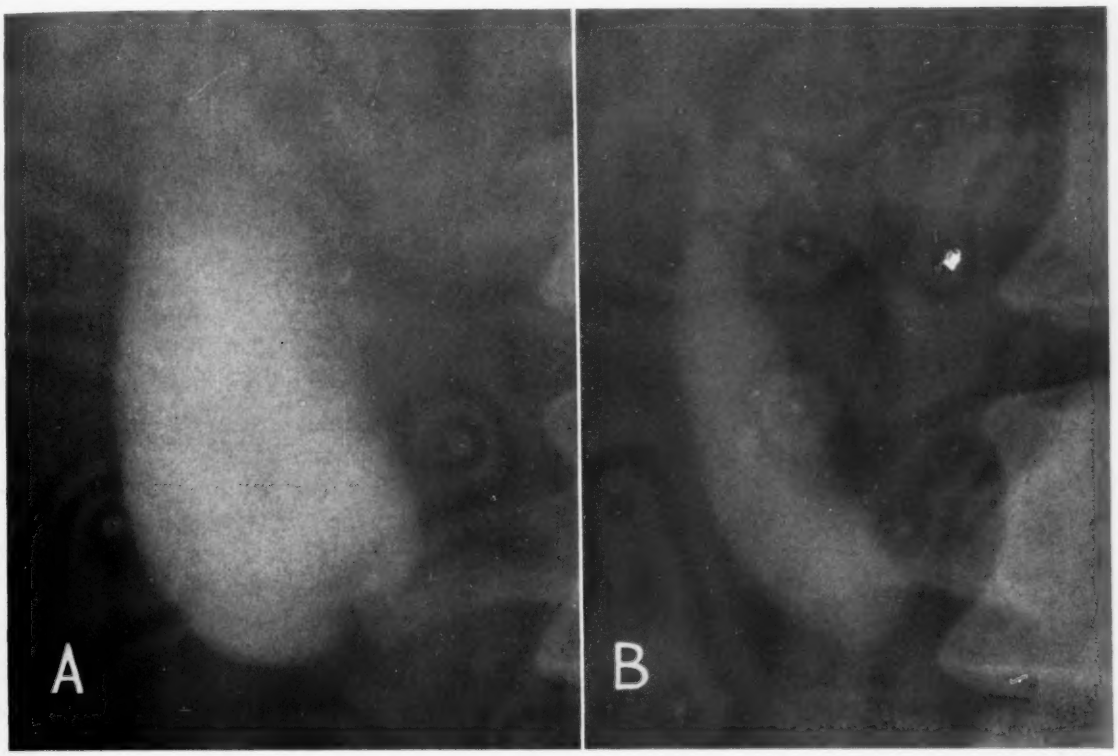

FIG. 1. Normal gallbladder shadow with 2 grams (four tablets) of telepaque. (*A*) Twelve hours after ingestion. (*B*) One hour after a fatty meal. Note the excellent visualization of cystic and common ducts in (*B*).

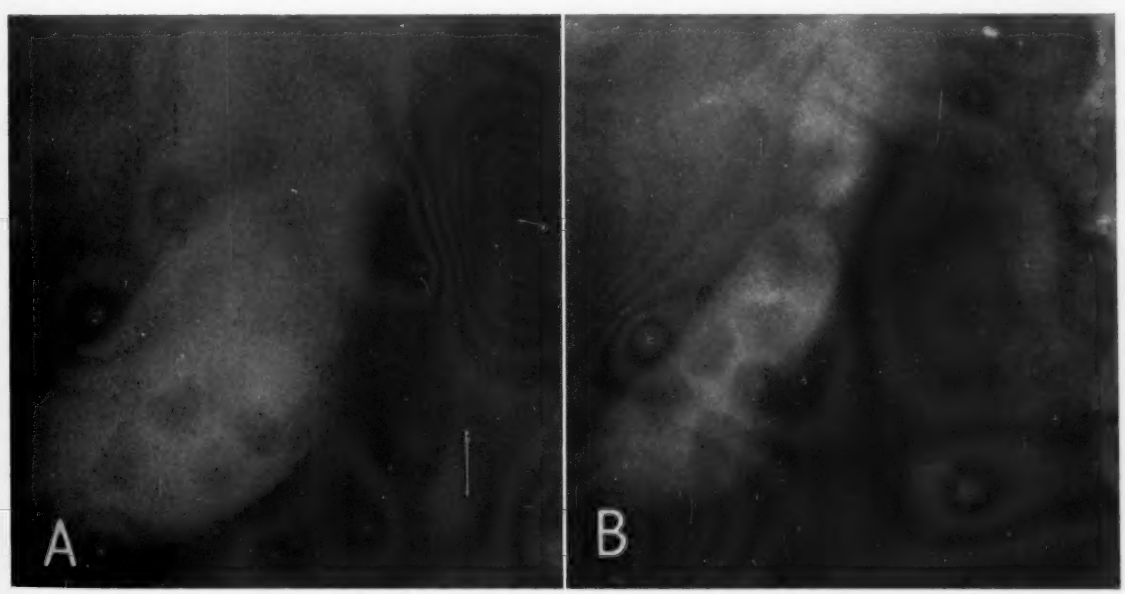

FIG. 2. Normally functioning but stone-containing gallbladder shadow with 2 grams of telepaque. (*A*) Twelve hours after ingestion. (*B*) One hour after a fatty meal. The positive shadow near the lower edge of (*B*) is presumably a calcified appendix epiploica.

TABLE I

SYMPTOMS FOLLOWING THE ADMINISTRATION OF TELEPAQUE

Total cases	50
No symptoms	78%
Nausea	10%
Diarrhea	8%
Nausea and diarrhea	2%
Dysuria	2%
Vomiting	0
Pain	0

Fifty patients comprise the group studied. No attempt at selection was made. All were ambulatory. They represent the first 50 patients referred for cholecystography after arrival of the new material.

In preparation for the gallbladder study, these patients were requested to carry out the following procedure:

1. Avoid fatty foods at the evening meal prior to examination.
2. Take six tablets of telepaque (3.0 grams) ten hours before the scheduled time of examination, that is, at 10 P.M. (This dose was doubled in patients weighing more than 165 pounds.)
3. Report to X-ray Department at 8 A.M. the following morning, having had no breakfast.

After satisfactory initial films had been obtained, a fatty meal was ingested. Follow-up post-cibum films were taken one hour thereafter.

As is usual with gallbladder studies done at this hospital, wet films were viewed during the course of examination and technique varied appropriately to insure satisfactory visualization.

During the course of the examination, the patient was specifically questioned in regard to the presence or absence of untoward symptoms, including nausea, vomiting, diarrhea, dysuria, frequency and insomnia.

RESULTS

The data are summarized in Tables I and II, the former listing the diagnostic results and the latter summarizing the various undesirable side reactions.

It is apparent that the major requirements of a satisfactory cholecystographic medium have been met. Comparison with priodax, the presently accepted standard, is rather difficult. Our series is small, too small for valid statistical evaluation. While large case series have been reported in the case of priodax, the results have shown ex-

TABLE II

DIAGNOSTIC RESULTS WITH TELEPAQUE

Total number of cases		50
I. Functioning (visualized)		96%
1. Normal	76%	
2. Cholelithiasis	18%	
3. Polypi	2%	
II. Non-functioning (non-visualized)		4%

TABLE III

SUMMARY OF SYMPTOMATOLOGY WITH PRIODAX

Author	Number of Cases	Number of Symptoms	Nausea	Vomiting	Diarrhea	Dysuria	Pain
Bryan and Pedersen[1]	845	—	20%	2%	30%	12%	12%
Dannenberg[3]	143	—	17%	3%	23%	17%	2%
Hefke[6]	600	—	8%	1%	11%	3%	—
Marshall[10]	50	—	0	2%	2%	4%	0
Ochsner[12]	300	56%	26%	3%	15%	5%	9%
Paul *et al.*[13]	114	—	28%	2%	23%	15%	—
Vaughan and Eichwald[14]	163	19%	2%	—	5%	5%	—
Wasch[15]	134	32%	18%	0	13%	20%	7%
Fong[4]	250	14%	23%	1%	43%	50%	16%

treme variability. A summary of the results obtained in various studies is presented in Table III. In general, it may be said that the telepaque figures are comparable to the best of the priodax and clearly superior to the majority of studies. If all the priodax statistics are taken together, and a weighted percentage incidence calculated for each of the sequela, the telepaque figures show marked superiority in each category. In those instances where the percentage of symptom-free patients is shown, telepaque shows a definite advantage. Direct questioning revealed no symptoms in 78 per cent of the cases. Symptoms, when present, were of a minor character: mild nausea, and slight diarrhea. The maximum number of loose movements was three. This occurred in only one case and was not accompanied by cramps. Only one patient complained of a combination of nausea and diarrhea. No instance of vomiting was encountered. The incidence of dysuria is definitely reduced. This is presumably due to the fact that telepaque is eliminated via the gastrointestinal tract while priodax is excreted in the urine. No pain was noted in any of our patients.

Evaluation of the diagnostic results is likewise difficult and for essentially the same reasons. In the telepaque series, the percentage of functioning, that is, visualized gallbladders, is very high. Only 4 per cent were considered non-functioning. Twelve per cent of all the priodax cases reported were not visualized. Of even more interest is the fact that 24 per cent of the functioning gallbladders, or 20 per cent of all gallbladders, showed calculi or polyps.

Priodax has been said to interfere with gallbladder emptying.[2] While our results do not permit rigid comparison in this respect, telepaque would not appear to merit criticism on this basis. The cystic and common bile ducts have been clearly visualized in a number of instances on the post-cibum films.

It is the definite impression of all observers who have viewed the films that the density of the gallbladder shadows is greater than that generally seen with priodax. This may be, in part, accounted for by the higher percentage of iodine in telepaque. In some instances, it has been suggested that stones may have been obscured by the marked density of the gallbladder.

Table IV

DIAGNOSTIC RESULTS WITH PRIODAX

Author	Number of Cases	Visualized	Visualized Plus Stones	Non-visualized
Hefke[6]	600	90%	—	10%
Marshall[10]	50	80%	12	20%
Paul *et al.*[13]	114	75%	—	25%
Vaughan and Eichwald[14]	163	89%	—	11%
Wasch[15]	134	87%	—	13%
Fong[4]	250	94%	—	6%

Early studies on priodax stressed the fact that usually all of the radiopaque material was absorbed from the intestine. As a consequence, the gallbladder could not be obscured by remnants in the large intestine. This is not true of telepaque. In almost all instances, residual radiopaque material has been present in the large intestine. However, there were no cases in which it obscured the gallbladder area in such a way as to interfere with interpretation of the films.

The fact that considerable residue was present in the bowel, and that the gallbladder shadows were of high density, suggested the possibility that the 3 gram dose of telepaque might be reduced. Investigation of this possibility is now under way. At the time of this writing, a series of 25 patients has been examined, using a 2 gram instead of the usual 3 gram dose. Satisfactory visualization has been obtained in each instance.

SUMMARY

This paper summarizes our experiences with a new cholecystographic medium, telepaque. A total of fifty cases has been studied with special reference to diagnostic

accuracy and untoward symptoms following its administration. Although the series is too small to warrant rigid conclusions, the results suggest that the material has certain distinct advantages. The percentage of untoward symptoms is low and the number of stone-containing gallbladders visualized is high. A serious clinical trial is clearly indicated.

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REFERENCES

1. BRYAN, L., and PEDERSEN, N. S. New gallbladder contrast medium: priodax. *Radiology*, 1944, *42*, 224–225.
2. COPLEMAN, B. Emptying of normal gallbladder with priodax. *Radiology*, 1946, *47*, 30–34.
3. DANNENBERG, M. Cholecystographic studies with priodax. AM. J. ROENTGENOL. & RAD. THERAPY, 1944, *51*, 328–335.
4. FONG, E. E. Some experiences with priodax. *Radiology*, 1946, *46*, 583–585.
5. GRAHAM, E. A., and COLE, W. H. Roentgenologic examination of gallbladder. *J.A.M.A.*, 1924, *82*, 613–614.
6. HEFKE, H. W. Cholecystography with priodax. *Radiology*, 1944, *42*, 233–236.
7. HOPPE, J. O. Unpublished data.
8. KLEIBER, N. Zur Frage der peroralen Darstellung der Gallenblase. *Deutsche med. Wchnschr.*, 1940, *66*, 1134–1135.
9. MCAULIFF, J., and MCCHESNEY, E. W. Unpublished data.
10. MARSHALL, W. A. Some observations on priodax. AM. J. ROENTGENOL. & RAD. THERAPY, 1943, *50*, 680–682.
11. MENEES, T. O., and ROBINSON, H. C. Oral administration of sodium tetrabromphenolphthalein. AM. J. ROENTGENOL. & RAD. THERAPY, 1925, *13*, 368–369.
12. OCHSNER, H. C. New cholecystographic preparation. AM. J. ROENTGENOL. & RAD. THERAPY, 1944, *51*, 326–327.
13. PAUL, L. W., POHLE, E. A., and BENSON, R. R. Oral cholecystography. *Radiology*, 1944, *42*, 226–232.
14. VAUGHAN, W. W., and EICHWALD, M. Priodax; contrast medium for cholecystography. *Radiology*, 1944, *43*, 578–581.
15. WASCH, M. G. New medium for glalbladder visualization. AM. J. ROENTGENOL. & RAD. THERAPY, 1943, *50*, 677–679.

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IODURON B BRONCHOGRAPHY

PRELIMINARY REPORT OF STUDY WITH WATER-SOLUBLE CONTRAST MEDIUM*†

By LUISE C. BRANDENSTEIN, M.D.

KERRVILLE, TEXAS

A WATER-SOLUBLE contrast medium has recently been produced which seems to possess a great number of advantages and represents definite progress in bronchography. The rapid elimination of the contrast medium from the bronchial tree makes one sure that any subsequent variation in the appearance of the lungs is not merely a result of residual iodized oil. Furthermore, the rapidity of elimination restores the airway promptly to its pre-bronchographic condition, thereby making thoracic surgery feasible within twenty-four hours. This substance, ioduron B, has the following properties. It is 3.5 diiodopyridon-4-N acetic acid dissolved in the sodium salt of cellulose glycol acid ether. Its specific gravity is 1.29. It is highly viscous, stable, and is rapidly absorbed. It was first described in 1948 by Fischer,[3] and by Fischer and Muelly[4] who have demonstrated its excellence as a roentgenographic contrast medium.

For nearly thirty years iodized oil has been used for demonstration of the bronchial tree. The roentgenographic results were satisfactory, but the greatest disadvantage of the iodized oil is its persistence in the lungs for a prolonged period. Days and years later, small and large amounts of residual opaque oil can be found on chest films, a most disturbing factor when parenchymal disease is suspected or is present. The iodized oil fails to mix with the bronchial secretions and can therefore lead to false conclusions. It accumulates in droplets and often obscures the delicate mucosal pattern of the bronchial tree. Ioduron B averts most of these difficulties.

For many years attempts have been made to find a satisfactory water-soluble contrast medium which would not only eliminate all or most of the difficulties one encounters with iodized oil but would also produce good contrast on the roentgenograms. Fischer has described the various substances previously used and their individual deficiencies.

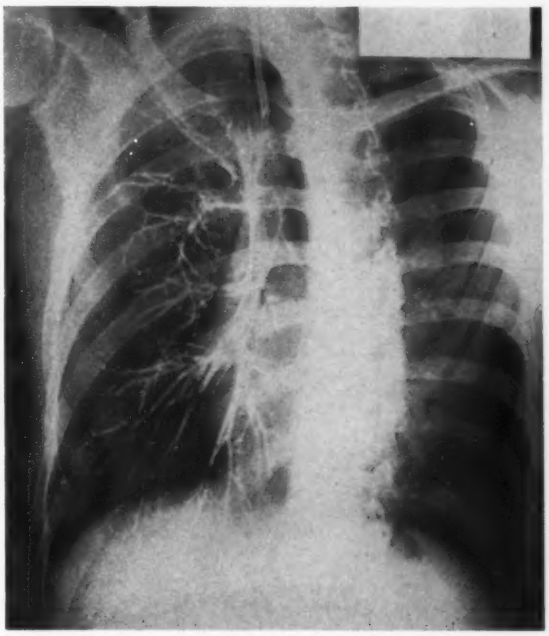

FIG. 1. Appearance of right bronchial tree immediately after instillation of ioduron B.

To date 25 patients have been subjected to bronchography with this new water-soluble contrast medium in this hospital. At least 50 per cent of them had active or inactive tuberculosis. No immediate general reactions were encountered in any of these patients. Two patients had a transient minimal rise of temperaure not ex-

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† Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are a result of her own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

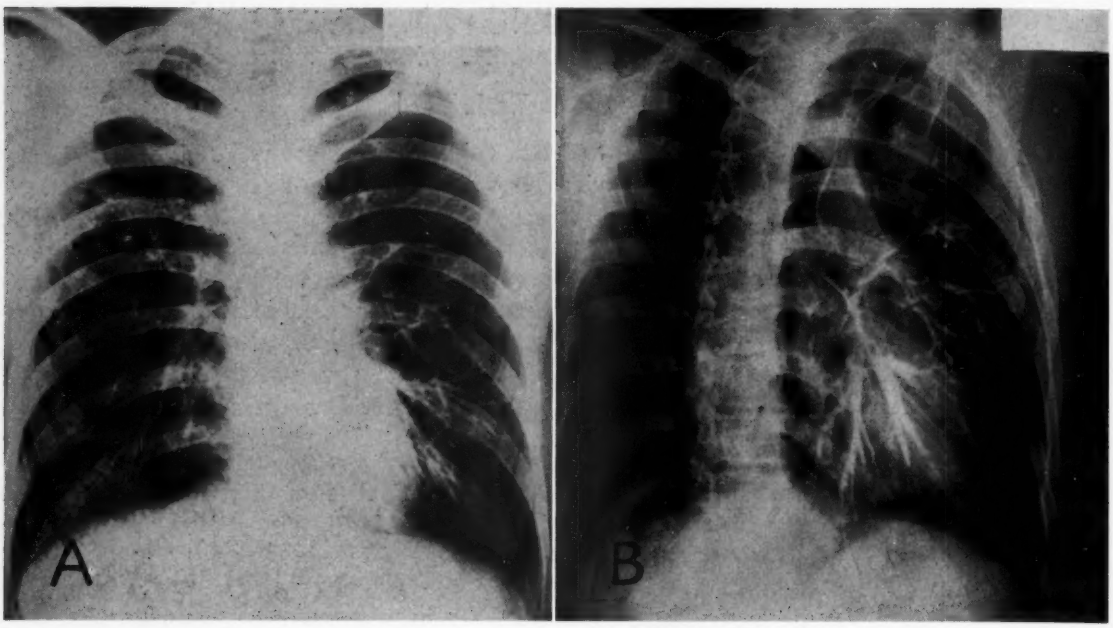

Fig. 2 (*A*) and (*B*). Filling of left bronchial tree with ioduron B five minutes after right. Note partial disappearance of contrast medium from right lung.

ceeding twenty-four hours. Three times the contrast medium entered the gastrointestinal tract and no reactions were observed. Thorough blood studies, liver and renal function tests were carried out before and after bronchography. To date no abnormalities traceable to this medium have been noted. A report of the investigation of physicochemical changes in the body will be submitted for publication in the near future.

Fig. 3. Ioduron B injected intratracheally appeared in the urinary tract within forty-five minutes.

The technique used is the same as for oil bronchography except that the local anesthesia has to be more meticulous because the dispersion of the contrast medium is more affected by coughing, and coughing is more likely to occur than with oil. Roentgenoscopy and serial bronchography have proved valuable. "Metras" catheters which are recommended by Fischer and Muelly were not used. Direct intratracheal instillation was performed using a No. 14 catheter. The filling of all lobes was accomplished by positioning of the patient on the tilt table or stretcher. The average quantity used for each side was 20 cc. of the solution at body temperature. This temperature is important in obtaining the best results. The affected side was examined first and frequently both sides were examined in succession. The examination has to be carried out with a well trained team in

order to assure speed of operation. The solution has to be injected more slowly than the oil contrast medium now being used. Films are taken as desired for the specific question to be answered. Routinely, films in frontal, oblique and lateral projections were taken in the upright position but there were several occasions where filming in the horizontal position seemed advantageous (Fig. 1). At the time of roentgenography of the contralateral side most of the contrast medium had disappeared from the first lung (Fig. 2). Films of the abdomen in properly prepared patients after a lapse of approximately twenty to forty-five minutes showed a satisfactory pyelogram in several instances (Fig. 3). Chest roentgenograms three to four hours after bronchography showed traces of contrast medium (Fig. 4) but all twenty-four hour chest roentgenograms were identical with films made prior to bronchography and are completely *free* from any visible foreign substance in the lungs (Fig. 5).

Studies in experimental animals to investigate possible morphologic tissue damage in all organs following the use of ioduron B are in progress and will be reported later.

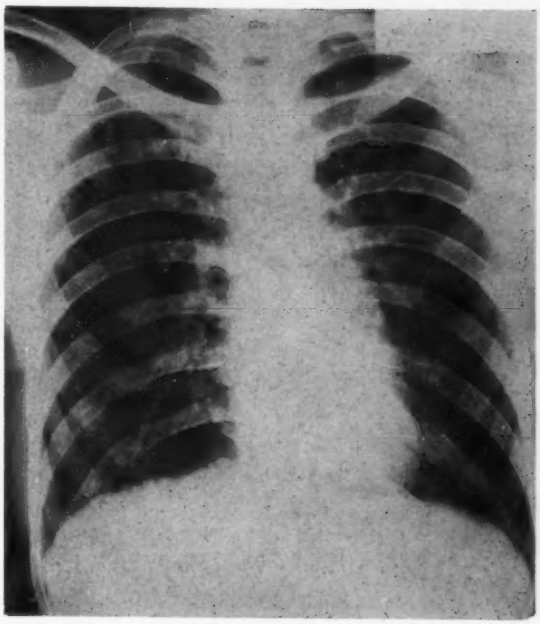

Fig. 4. Roentgenogram taken three hours after bronchography shows only traces of contrast medium within lungs.

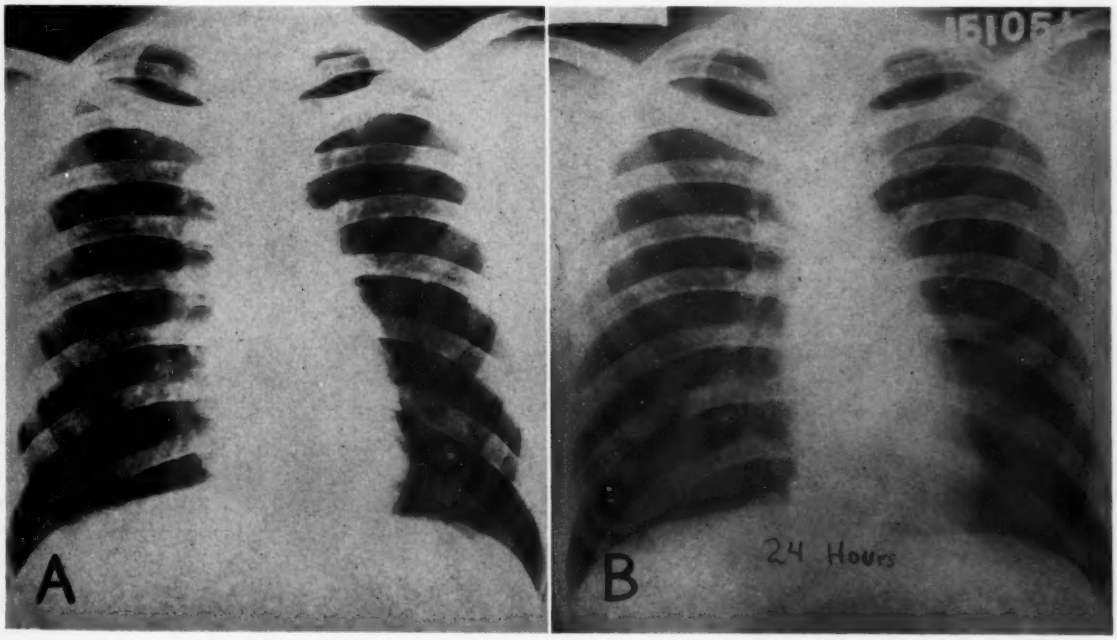

Fig. 5. (*A*) Roentgenogram taken twenty-four hours before bronchography. (*B*) Roentgenogram twenty-four hours after bronchography identical with preliminary roentgenogram.

SUMMARY

A series of twenty-five cases in which bronchography was done using a water-soluble contrast medium (ioduron B) is presented and good contrast on the bronchograms is demonstrated. Roentgenograms of the chest twenty-four hours following bronchography are free from visible contrast material. No harmful effects have been found to date.

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REFERENCES

1. Corper, H. J., and Freed, H. Intratracheal injection of oil for diagnostic and therapeutic purposes. *J.A.M.A.*, 1922, *79*, 1739–1743.
2. Derra, E. Operative Bronchiektasenbehandlung in neuerem Licht. *Deutsche med. Rdsch.*, 1949, *3*, 16.
3. Fischer, F. K. Visualization of bronchial tree with water-soluble contrast medium. *Schweiz. med. Wchnschr.*, 1948, *78*, 1025.
4. Fischer, F. K., and Muelly, K. Contribution to technique of bronchography with water-soluble contrast medium, ioduron "B." *Schweiz. med. Wchnschr.*, 1948, *78*, 1027.
5. Fischer, F. K. Die Jodoelbronchographie als schädigender Diagnostischer Eingriff. *Schweiz. med. Wchnschr.*, 1950, *80*, 273–278.
6. Fischer, F. K. Beitrag zur Kenntnis der Veränderungen im Bronchogramm bei chronischer Bronchitis. *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, 1950, *72*, 653–659.
7. Sante, L. R. Practical observations on use of iodized oil in bronchography. Am. J. Roentgenol. & Rad. Therapy, 1934, *32*, 763–768.

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ENDOMETRIOSIS: ITS MANAGEMENT AND END RESULTS*

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THE presence of ectopic endometrial tissue growing in and on the pelvic structures of a woman is known as endometriosis. This term was suggested first by Sampson[29] in 1921 when he introduced his theory of reflux menstruation through the fallopian tubes as the etiology of the condition. Although this supposition has not been universally accepted, his nomenclature has been retained.

Cullen[6] was the first to definitely identify endometrial tissue growing outside the uterus, having reported an adenomyoma of the round ligament in 1896. Russell[28] reported endometrial invasion of the ovary in 1899. Many articles appeared subsequently as the condition became better recognized at operation. Surgeons became increasingly aware of the disease through the writings of Cullen,[7] Meyer,[23] Novak[24] and Sampson.[29]

We have reviewed 142 cases of endometrosis seen at the Cleveland Clinic during the period from 1939 to 1949. This review includes all cases, whether treated medically, surgically or by roentgen therapy. There may be some objection to the inclusion of cases in which the diagnosis of endometriosis was made without laparotomy or histopathologic study. We agree with Gardner[10] that, in many instances, the history and physical findings were so typical that a clinical diagnosis of endometrosis could be made with assurance but realize that this is somewhat at variance with the opinions of others.[9,12,27] Holmes[16] found that the correct clinical diagnosis was made in 48.7 per cent of his cases. Of our surgically proved cases 38 per cent were correctly diagnosed preoperatively.

ETIOLOGY

A great deal written about endometriosis has concerned its etiology. The most popular theory is Sampson's,[29] known as the "implantation theory." He postulated that during menses small bits of endometrial tissue are carried refluxly through the fallopian tubes to the pelvic cavity where they become implanted and flourish under the influence of the ovarian hormones. The fact that most of the implants occur in the ovary and cul-de-sac seems to support this view because these structures are in close proximity to the fimbriated ends of the tubes.

Meyer[23] and Novak[25,26] disagreed with this theory and offered the so-called "celomic theory." Following the lead of the embryologists, they contend that the mucosa of almost the entire genital canal as well as the germinal epithelium of the ovary represents varying degrees of modification of the celomic epithelium, the primitive peritoneum. It is not surprising that under the proper stimulus, these cells may differentiate into cells resembling the endometrium.

The theories of embryonic rests of the müllerian ducts or wolffian body and of metastases from the uterus through lymphatics and blood vessels have been discarded. Regardless of the etiology, it is well established that the growth and persistence of the ectopic endometrial tissue is dependent on the continued activity of ovarian function.

INCIDENCE

The exact incidence of endometriosis is difficult to estimate. Frequently the lesions

* From the Cleveland Clinic and the Frank E. Bunts Educational Institute. Presented at the Fifty-first Annual Meeting, American Roentgen Ray Society, St. Louis, Mo., Sept. 26–29, 1950.

cause mild symptoms, for which medical advice is not sought, or no symptoms at all. At times the lesions may be so small that they are not recognizable even at operation. Green-Amytage[11] found an incidence of 8.9 per cent in 1,000 cases. Fallas and Rosenblum[9] found only 1.62 per cent in 15,975 pelvic laparotomies. Nevertheless most authorities believe that endometriosis accounts for about 10 per cent of pathologic conditions encountered in the female pelvis.[11,12]

Meigs[21] believes that the incidence of endometriosis is increasing because modern women have too many menstrual periods, that is, they do not get married early enough or have enough babies; therefore, the uninterrupted stimulation of the tissues by estrin either predisposes to or causes endometriosis. He also believes that the incidence is higher among the so-called upper class. He found an incidence of 16.7 per cent in his private practice.

Others have attributed increased activities of the modern woman, her participation in sports and similar activities, as possible contributing factors.[8] While these suppositions cannot be substantiated they represent the considered opinions of men who observe large numbers of women with many types of gynecologic conditions.

Endometriosis is most frequent in the fourth decade of life. It is definitely a desease occurring during menstrual life. Three fourths of our cases were between the ages of thirty and forty-five. The average age of the patients was 35.9 years, with the majority between thirty and forty (Table 1). Our youngest patient was twenty and the oldest sixty-one.

Involvement of the uterus with endometriosis which is called adenomyosis occurs in the latter part of the menstrual life of the patient, while endometriosis involving the ovaries and other structures occurs earlier.

TABLE I

DISTRIBUTION OF CASES ACCORDING TO AGE
OLDEST 61, YOUNGEST 20

Age groups	20–30	30–35	35–40	40–45	45	Total
No. of cases	30	40	29	27	16	142
Percentage	21.1	28.2	20.4	19	11.3	100

PATHOLOGY

In general, two types of endometriosis are distinguished: (1) the internal type, which is called "adenomyosis," and (2) the external type.

In the internal type, the endometrial tissue invades the musculature of the uterus. It may be a diffuse process in which the uterus is enlarged to two or three times its normal size. If the involvement is discrete, the surface presents an irregular surface similar to that seen in fibroids.

The external type includes all lesions of the pelvic peritoneum, ovary, cul-de-sac, uterosacral ligaments, sigmoid and rectum. The so-called chocolate cysts of the ovaries which are bilateral in approximately 30 to 50 per cent of cases are of this type. The cysts may rupture during operation and liberate their contents into the pelvis; this results in endometrial implants. Often only dense adhesions between the ovary, ureters and bowel, or small puckered hemorrhagic areas of a dark bluish color may be visible. These are more frequently seen on one or both uterosacral ligaments or in the cul-de-sac. The tubes are, amazingly enough, often free of disease.

The microscopic picture of endometrial implants is exactly similar to the endometrium of the uterus, although it is not necessarily in the same physiologic phase as a biopsy from the uterine cavity.

Table II indicates the frequency of involvement of different structures in our series. In this table we have listed the primary site of involvement or the involvement which appeared to cause the major symptoms. It is apparent that it is uncommon for only one site or organ to be involved, with the exception of adenomyosis. The process which initiates pelvic endometriosis is generalized and it is not surprising that usually several areas and organs are involved simultaneously or consecutively.

In our series the ovaries were involved

in 58.5 per cent. In 26.1 per cent one or both ovaries were apparently the only structures affected. This agrees with the findings of others.[2,15] Frequency of involvement of the ovaries is probably due to their location near the fimbriated ends of the tubes so that endometrial tissue would be deposited directly on them. Secondly, the ovaries are the site of production of hormones which stimulate endometrial cells; hence any stimulation is more apt to occur in the ovaries than elsewhere. In 32.1 per cent, lesions were found in the ovaries in 4 of our cases. A puckering of the serosa by the lesions was seen and in all instances there was evidence of disease elsewhere in the pelvis. Sigmoid involvement is a late manifestation.

In Cattell's[3] series 16.3 per cent of the patients observed had involvement of the sigmoid and rectum. Jenkinson and Brown[17] believe that approximately 25 per cent of patients with pelvic endometriosis have lesions of the rectosigmoid. Most of these lesions indicate serosal implantations which do not invade the muscle of the bowel wall.

Table II

SITES OF MAJOR INVOLVEMENT
PRINCIPAL

Site of major involvement	Uterus	Ovary alone	Ovary with other involvement	Cul-de-sac; uterosacral ligaments; rectovaginal septum	Sigmoid	Bladder	Appendix	Abdominal scar	Canal of Nuck
No. of cases	27	37	46	23	4	1	2	1	1
Percentage	19.0	26.1	32.4	16.2	2.8	0.7	1.4	0.7	0.7
		58.5							

as well as in the cul-de-sac, rectovaginal septum, uterus, bladder, and other sites.

The uterus was the second most frequently involved structure. It was primarily affected in 19 per cent of our cases. Actually it was implicated more frequently than this, but usually in a diffused process with the fundamental lesion in the ovaries. Small implants along the posterior surface of the uterus are often an accompaniment of chocolate cysts of the ovaries.

Involvement of the cul-de-sac, uterosacral ligaments and rectovaginal septum occurred in 16.2 per cent of our cases. This is the usual location of the lesions which are diagnosed by physical examination when a painful mass or small nodules are palpated in the cul-de-sac or along the uterosacral ligaments, or a hard nodule is felt posterior to the cervix in the rectovaginal septum.

The sigmoid was found to be infiltrated

The bladder is less frequently involved than the rectum or sigmoid. One of our patients had bladder involvement which was recognized cystoscopically and the diagnosis established by biopsy.

Other less commonly involved areas are the appendix, canal of Nuck, small intestine, abdominal scars, cervix and vagina. Schwarz[32] reported a proved case of endometriosis of the lung. Berman,[1] reviewing the literature up to 1935, found reports of 68 cases of endometriosis of the umbilicus.

An interesting feature emphasized by Cattell[2] is that the fallopian tubes appear to be involved to a minimum degree and that, at operation, it is possible to differentiate between chronic pelvic inflammation and endometriosis by the lack of involvement of the tubes in the latter.

SYMPTOMS

Table III shows the frequency in occur-

rence of the principal symptoms in our cases. It will be noted that the percentage is over 100 because in some instances it was not possible to deduce only one major symptom for each case.

Dysmenorrhea, which is acquired or progressive in nature, is the most characteristic symptom of the disease. The pain begins a few days before menstruation and, while it eases with the onset, never completely disappears. Often the patient states that she has always experienced painful periods, but that they have become steadily worse. The fundamental reason for the dysmenorrhea is obscure but may be due to engorgement and consequent swelling of the endometrial tissue which causes pressure pain. This pain is an especially common complaint with adenomyosis but is also a frequent symptom of external endometriosis.

Pelvic pain not associated with the menstrual period may be localized to one side or to the groin or inner aspect of the thighs. There may be acute exacerbations with nausea and vomiting suggesting acute abdominal disease. The pain is often aggravated by activity or exercise.

Involvement of the uterosacral ligaments and rectovaginal septum causes a sensation of a mass in these regions, and a bearing down feeling with backache. Many of our patients had been referred to orthopedists for the latter complaint before the underlying cause was discovered.

Disturbances of menstruation usually take the form of prolonged flow accompanied by the passage of numerous clots. Intermenstrual bleeding is infrequent. Fallas and Rosenblum[9] found that 47.7 per cent of their patients complained of excessive uterine bleeding.

Involvement of sigmoid or rectum is accompanied by pain in the affected organ plus constipation which is most severe at the time of menstruation; however, diarrhea and bleeding per rectum are uncommon manifestations.

Bladder involvement causes severe dysuria which is worse just before and during the menses, but hematuria does not occur because the bladder mucosa is not invaded.

Table III

SYMPTOMS

	Backache	Dysmenorrhea	Meno- or metrorrhagia	Pelvic pain	Rectal pain	Dyspareunia	Total
No. of cases	11	81	59	29	3	5	188
Percentage	7.7	57	41.5	20.4	2.1	3.4	*132.1

* Some patients had more than one symptom accounting for the 132.1 per cent.

Involvement of the round ligament and the canal of Nuck may simulate an incarcerated inguinal hernia.

Dyspareunia is due to involvement of the cul-de-sac and uterosacral ligaments. However, most patients are reluctant to impart this information.

Other symptoms, such as headache, nervousness, nausea and feeling of tension occurring prior to and during the menses, are too generally experienced to be of diagnostic value.

Sterility is common. Of our married patients 37.1 per cent had no children but the majority had one or two. Payne[27] reports that 40 per cent in his series were sterile. Sterility is probably due to the fact that the ovaries are bound down in unusual locations so that fibriated ends of the tubes do not approximate the rupturing follicle at the time of ovulation. Intrinsic alteration of ovarian structure may be an additional factor.

DIAGNOSIS

Endometriosis may be strongly suspected from the history and physical examination. A woman between the ages of twenty-five and forty-five years complaining of increasing dysmenorrhea of an acquired type, excessive menstrual flow, low back pain (worse at the time of menstruation), a bearing down sensation in the pelvis or pain referred to the inner thighs, who on examination is found to have a tender pelvic mass or small painful nodules in the cul-de-sac or along the uterosacral ligaments, may be presumed to have endometriosis.

The uterus may or may not be enlarged but it is frequently enlarged in cases of adenomyosis. This organ will usually be found retroverted into the cul-de-sac and impossible to move into an anterior position. An enlarged ovary containing a chocolate cyst may be palpated and mistaken for a uterine fibroid.

Curettage is of no help in making the diagnosis, although hyperplasia of the endometrium is often associated with endometriosis. Henderson[13] found endometrial hyperplasia in 25 per cent of 82 cases of adenomyosis observed and indicates that prolonged excessive estrin stimulation may be an etiologic factor.

Special examinations which may be of value include cystoscopy, sigmoidostomy and roentgenologic examination with barium enema. In each of the endoscopies, bluish or purplish pink lesions may be seen.[3,14,17] Fixation of the sigmoid in the region of the lesion is also revealed at time of sigmoidoscopy. Barium enema will reveal a filling defect of considerable length with fairly sharp margins. The mucosa is intact, in distinct contrast to carcinoma which may be excluded also by lack of gross bleeding and an apparently satisfactory general condition.

TeLinde and Rutledge[33] have found culdoscopy a useful method of diagnosing pelvic conditions in women. The instrument utilized is similar to a cystoscope and is introduced through a small incision in the posterior fornix. After the introduction of air most of the organs of the pelvis may be visualized. This is a rather specialized procedure but in trained hands is an effective method of obtaining a positive diagnosis without laparotomy.

The differentiation of endometriosis from functional complaints is not always easy, particularly in the early stages when the implants are small, soft and not readily palpable on pelvic examination. In studying the histories of our cases we found that the initial impression of the examining physician often suggested primary dysmenorrhea or a functional state. It is common practice to defer pelvic examination if the patient is menstruating but if the diagnosis is not clear pelvic examination on the third day of the menstrual period will many times reveal painful nodules in the cul-de-sac and uterosacral ligaments and establish the correct diagnosis. Small test doses of testosterone may be given during the ten days preceding the next expected menstrual period. If there is improvement in the discomfort it is additional evidence of the presence of ectopic endometrium.

ASSOCIATED PELVIC CONDITIONS

A characteristic feature of endometriosis is the association of other pelvic abnormalities which sometimes may overshadow the symptoms of endometriosis, or vice versa.

Uterine endometrial hyperplasia is present in about 25 per cent of cases.

Fibroids are not uncommon in association with endometriosis. It is postulated that the same stimuli of implant production causes the myometrium to produce fibroids. Fallas and Rosenblum[9] reported fibroids present in 41.5 per cent, and Payne[27] in 63 per cent of their patients. In our series fibroids were present in 37.7 per cent of those operated upon.

Retroversion of the uterus has been suggested as a contributing cause of endometriosis. It is presumed that this malposition obstructs the free flow of menstrual blood and encourages retrograde flow through the tubes. The incidence has been reported

as from 6 to 45 per cent and existed in 14 per cent of our cases. Other pelvic conditions, such as chronic pelvic inflammatory disease and ovarian cysts, are found less frequently.

It is important to include the morphologic similarity of hemorrhagic luteal cysts and endometriosis of the ovary. King[18] points out that they have many gross features in common and are indistinguishable without microscopic section.

The influence of previous pelvic operations in initiating endometriosis has never been satisfactorily established; however, a considerable number of patients have had previous operations. Whether these operations caused the condition or whether they were performed for symptoms due to undetected endometriosis is impossible to determine. Dilatation and curettage, uterine suspension, oophorectomy, appendectomy and hysterectomy had been performed upon 35.5 per cent of our patients.

Table IV

DISTRIBUTION OF CASES ACCORDING TO METHODS OF TREATMENT AND AGE

Type of treatment	No. of cases	Percentage	Average age
Radical surgery	42	29.5	40.3
Conservative surgery	40	28.1	32.8
Roentgen therapy	34	24.1	37.5
Medical	15	10.5	30.0
Observation	10	7.1	36.2
Refused treatment	1	0.7	39.0
Total	142		

TREATMENT

Since the growth, development, and progression of the ectopic endometrial tissue is dependent upon ovarian activity, treatment becomes relatively simple. When the indications are clear, the ovarian function may be terminated either by oophorectomy or roentgen therapy. However, since the majority of the patients are at the height of their sex life, it is desirable to use conservative measures whenever possible.

Surgical treatment may be radical or conservative. Any surgical procedure which preserves ovarian activity is conservative regardless of how extensive the procedure, but if the ovaries are removed it is radical.

At the time of operation the surgeon must use judgment in coping with the condition present in the pelvis. In women under thirty-eight years of age he should make every effort to conserve some ovarian tissue. Levi[19] has recently shown that little ovarian tissue is necessary for normal existence and even conception. In young persons the major lesions should be removed if possible. An attempt should be made to dissect away endometrial cysts from normal ovarian tissue, at least on one side. If the uterus is definitely involved it may be necessary to remove it. Small lesions on the peritoneum may be dealt with successfully by sharp point cautery. Lesions of the rectovaginal septum, cul-de-sac and rectosigmoid are best left intact and oophorectomy performed to relieve the condition.

Many surgeons employ conservative measures and observe the patient over a number of months. If symptoms again become intolerable then permanent interruption of menses by roentgen therapy is employed.

When intestinal obstruction is caused by endometriosis of the sigmoid, resection of the lesion may be necessary because it is not always possible to distinguish this condition from carcinoma.[3,14,20] However, if the lesion is found to be endometriosis, a colostomy above the area involved is indicated which should be followed by roentgen therapy and closure of the colostomy after the endometriosis subsides.

In our series, 42 cases (29.5 per cent) were treated by radical surgery (Table IV). The average age of the patients was 40.3 years, which is conceded generally to be the time for performing radical procedures. In the majority of instances the operation was bilateral oophorectomy although many patients also had hysterectomies. Some patients had been operated upon elsewhere, and had had one ovary removed for var-

ious conditions. When treated at the Clinic, removal of the other ovary constituted a radical procedure.

Conservative operations were performed upon 40 patients (28.1 per cent) (Table IV). These patients were younger that those who had radical surgery, the average age being 32.8 years. Cattell and Swinton[2] reported an average of 41.5 years in radically treated cases and 29.2 years in those treated conservatively. The procedures in these cases ranged from unilateral oophorectomy and hysterectomy to excision of local lesions.

None of our cases was treated by resection of the presacral plexus. However, some surgeons (Counseller,[4,5] Cattell and Swinton[2]) believe that this procedure will relieve the pain due to adenomyosis but not that caused by widespread involvement of the pelvis.

Roentgen therapy is useful in the management of endometriosis. It is recognized that the function of the ovaries can be readily suppressed or eliminated by roentgen therapy, depending upon the age of the patient, the quantity of radiation administered, and the radiosensitivity of the ovarian follicles. The developing and maturing follicles are the most radiosensitive.[30] Primary follicles are somewhat more resistant.

It is estimated that 400 r delivered to the ovaries in the course of a week will usually produce permanent amenorrhea, but the administration of 500 to 600 r is preferable to be certain that the effects are permanent. All of the treatment may be given anteriorly in increments of 250 r on the skin daily or for large women a sacral field may be necessary alternating with the anterior field. Most patients have at least one menstrual period following such a course of treatment; therefore, all should be forewarned of this possibility and that the effects of treatment and relief of symptoms will not be immediate.

In our series, 34 patients (24.1 per cent) were given roentgen therapy. The average age was 37.5 years. Six were treated following operations which proved to be ineffective; 2 of these supposedly had had both ovaries removed and 4 had been treated with conservative surgery. Although 18 of the 34 patients (52.9 per cent) had previous pelvic surgery in other institutions, they continued to have symptoms severe enough to warrant roentgen therapy. It was necessary to give a second course of roentgen therapy to 2 patients because of persistence or recurrence of symptoms.

The practice of giving roentgen therapy for endometriosis without operative or pathologic proof may be criticized; nevertheless we believe that the history and physical examination are quite characteristic. However, a majority of our patients given roentgen therapy had been operated upon. We believe that women who are incapacitated by severe pain should have roentgen therapy; it is the best treatment with the least morbidity and relief is permanent.

Some writers underestimate roentgen therapy on the basis that is is not effective against chocolate cysts and adenomyosis.[4,12] This is contrary to our experience. Roentgen therapy is preferable when there are lesions of the sigmoid, bladder, rectovaginal septum[17] and when symptoms persist or recur after surgery. Not infrequently experienced surgeons will perform conservative procedures with full realization that they may not be curative but with the understanding that, if the symptoms persist, roentgen therapy may be given.

We have not employed intracavitary radium therapy and see no indication for the procedure.

Medical treatment was tried in 15 of our cases because of the age of the patient, because the symptoms were not severe, or because the patient hoped to become pregnant. Medical treatment consisted almost entirely of androgen therapy which depresses the activity of the anterior lobe of the pituitary and production of ovarian hormones. Usually 10 mg. of methyl testosterone was given orally twice daily for ten days preceding the next expected menstruation. If there was little or no improve-

ment, the dosage was increased or it was given throughout the menstrual cycle. The results were disappointing as only 13.3 per cent could be considered as being benefited. None of the undesirable masculinizing effects were observed. Recently estrogens in large doses up to 100 mg., or more, daily of stilbestrol have been used but we have had no experience with this treatment.

One of our patients refused any kind of treatment. Ten with especially mild symptoms which could be controlled by mild sedation and other methods, and those near the time of the menopause were treated expectantly. We believe it wise, if possible, to allow older patients to continue into the menopause at which time stimulation of the aberrant tissue will cease.

TABLE V

RESULTS OF THE DIFFERENT METHODS OF TREATMENT

	Good	Fair	Poor	Good result
				per cent
Radical surgery	33	5	4	78.5
Conservative surgery	30	4	6	75.0
Irradiation	33		1	97.0
Medical	2	10	3	13.3

RESULTS OF TREATMENT

The results we obtained by the various methods of treatment are listed in Table v. As might be expected, the best results followed the most radical procedures. Radical surgery did not give as good results as irradiation, which is probably due to the fact that when there is extensive involvement some ovarian tissue is left and symptoms persist.

Conservative surgery is adequate in the majority of instances and generally chosen by the surgeons when possible. Satisfactory relief was obtained in 75 per cent of our cases treated by conservative surgery. Of course the symptoms of these patients were not as severe as of those treated by radical means or roentgen therapy. Often the surgeon is in some doubt as to whether he should remove both ovaries but decides to risk recurrence in order to save some ovarian function; he is often rewarded with satisfactory results. None of the patients originally operated upon at the Clinic required a second operation; however 6 of these were treated by irradiation as a secondary procedure with excellent results.

Roentgen therapy produces a higher percentage of good results than any other method. In our series 97 per cent of the cases treated were symptom free when last seen.

We believe that temporary amenorrhea is undesirable because if a patient has symptoms severe enough to warrant ablation of the ovaries the procedure should be permanent. Some consider that many disturbances of menopause are avoided by temporary or incomplete sterilization. While this may be true, it must be remembered that irradiation does not have a direct effect on the aberrant tissue but rather suppresses its activity indirectly by ovarian inactivation, and if this is not complete there may be recurrence of symptoms. Attempted temporary sterilization by roentgen therapy bears no resemblance to conservative operations during which a diseased ovary, uterus and broad ligament may be removed and the patient experiences relief due to excision of these tissues rather than effects upon the ovaries.

Our records are incomplete regarding the number of pregnancies which have followed conservative treatment. Others report pregnancy as having resulted following conservative surgical procedures or roentgen therapy. This is an infrequent but a gratifying result when it occurs.[22,31]

The only disagreeable effects of producing permanent cessation of menstruation by roentgen therapy have been the menopausal symptoms which usually appear in the second month following treatments. Wherever possible we attempt to curb these disturbances by reassurance or mild sedatives such as phenobarbital or bromides or a

mixture of these. In a few instances the symptoms may be so aggravating that replacement therapy is indicated but this should be avoided because of the possibility of inducing false menstration or "spotting."

SUMMARY AND CONCLUSIONS

A series of 142 cases of endometriosis seen at the Cleveland Clinic during a ten year period from 1939 to 1949 has been reviewed.

Dysmenorrhea, which is acquired and progressive in character, is the most common symptom of endometriosis. It occurred in 57 per cent of our cases; excessive menses occurred in 41.5 per cent. Other complaints such as headache, pelvic pain, rectal distress and dyspareunia occurred less frequently.

Physical findings include painful pelvic masses or small nodules along the uterosacral ligaments.

Of the married patients 37.1 per cent were sterile.

The ovary is the most common site of involvement (58.5 per cent) followed by the uterus, cul-de-sac, uterosacral ligament and rectovaginal septum.

Pelvic operations had been performed upon 35.5 per cent of the patients before roentgen therapy was given.

Fibroids, frequently associated with endometriosis, were observed in 37.7 per cent of our surgical cases.

Treatment depends on the age of the patient, extent of involvement and severity of symptoms. Ovarian function is necessary for the continued growth of the ectopic endometrium; therefore ablation of the ovaries, either surgically or by irradiation, results in relief of symptoms and regression of the lesions. Conservative measures with preservation of some ovarian activity is desirable whenever possible.

In our series, roentgen therapy produced the best results with the least morbidity and was satisfactory in 97 per cent of patients treated. Menopausal symptoms following irradiation are best treated conservatively.

Medical treatment of endometriosis with hormones, in our experience, has been disappointing.

Cleveland Clinic
Cleveland 6, Ohio

REFERENCES

1. Berman, W. Endometriosis of umbilicus. *Am. J. Obst. & Gynec.*, 1939, *37*, 503–505.
2. Cattell, R. B., and Swinton, N. W. Endometriosis, with particular reference to conservative treatment. *New England J. Med.*, 1936, *214*, 341–346.
3. Cattell, R. B. Endometriosis of colon and rectum with intestinal obstruction. *New England J. Med.*, 1937, *217*, 9–16.
4. Counseller, V. S. Endometriosis. *Am. J. Obst. & Gynec.*, 1938, *36*, 877–888.
5. Counseller, V. S. Clinical significance of endometriosis. *Am. J. Obst. & Gynec.*, 1939, *37*, 788–797.
6. Cullen, T. S. Adenomyoma of round ligament. *Johns Hopkins Hosp. Bull.*, 1896, *7*, 112–114.
7. Cullen, T. S. Distribution of adenomyomas containing uterine mucosa. *Arch. Surg.*, 1920, *1*, 215–283.
8. Dougal, D. Problem of endometriosis. *Am. J. Obst. & Gynec.*, 1938, *35*, 373–386.
9. Fallas, R., and Rosenblum, G. Endometriosis. *Am. Obst. & Gynec.*, 1940, *39*, 964–975.
10. Gardner, G. H. Pelvic endometriosis. *Northwest Med.*, 1939, *38*, 367–370.
11. Green-Armytage, V. B. Endometriomata. *Brit. M. J.*, 1933, *1*, 602–604.
12. Haydon, G. B. Study of 569 cases of endometriosis. *Am. J. Obst. & Gynec.*, 1942, *43*, 704–709.
13. Henderson, D. N. Incidence of endometrial hyperplasia with uterine fibroids and external and internal endometriosis (adenomyosis). *Am. J. Obst. & Gynec.*, 1941, *41*, 694–697.
14. Hepburn, J. J. Endometriosis as cause of acute intestinal obstruction. *New England J. Med.*, 1937, *217*, 6–8.
15. Hill, L. L., Jr. Aberrant endometrium. *Am. J. Surg.*, 1932, *18*, 303–321.
16. Holmes, W. R. Endometriosis. *Am. J. Obst. & Gynec.*, 1942, *43*, 255–266.
17. Jenkinson, E. L., and Brown, W. H. Endometriosis. *J.A.M.A.*, 1943, *122*, 349–354.
18. King, E. S. J. Morphological similarity of certain luteal cysts and endometriosis of ovary. *Surg., Gynec. & Obst.*, 1930, *50*, 1–9.
19. Levi, A. A. Ovarian conservation during surgery, with reference to bilateral dermoids and endometriosis. *New England J. Med.*, 1948, *238*, 83–85.
20. Mayo, C. W., and Miller, J. M. Endometriosis

of sigmoid, rectosigmoid and rectum. *Surg., Gynec. & Obst.*, 1940, *70*, 136–139.
21. MEIGS, J. V. Editorial. Endometriosis—possible etiological factor. *Surg., Gynec. & Obst.*, 1938, *67*, 253–255.
22. MEIGS, J. V. Medical progress; gynecology; endometriosis. *New England J. Med.*, 1942, *226*, 147–153.
23. MEYER, R. Adenomyosis, adenofibrosis and adenomyoma. In: Veit, J., and Stoekel, W. Handbuch der Gynäkologie. Third edition. J. F. Bergmann, München, Vol. 6, p. 356.
24. NOVAK, E. Significance of uterine mucosa in fallopian tube, with discussion of origin of aberrant endometrium. *Am. J. Obst. & Gynec.*, 1926, *12*, 483–526.
25. NOVAK, E. Pelvic endometriosis. Am. J. Obst. & Gynec., 1931, *22*, 826–837.
26. NOVAK, E. Pelvic endometriosis and its treatment. *Am. J. Surg.*, 1936, *33*, 422–427.
27. PAYNE, F. L. Clinical aspects of pelvic endometriosis. *Am. J. Obst. & Gynec.*, 1940, *39*, 373–382.
28. RUSSELL, W. W. Aberrant portions of Müllerian duct found in ovary. *Johns Hopkins Hosp. Bull.*, 1899, *10*, 8–10.
29. SAMPSON, J. A. Perforating hemorrhagic (chocolate) cysts of ovary. *Arch. Surg.*, 1921, *3*, 245–323.
30. SCHMITZ, H. Treatment of myoma and sarcoma of uterus. In: Treatment of Cancer and Allied Diseases. Pack, G. T., and Livingston, E. M., Editors. Paul B. Hoeber, Inc., New York, 1940, Vol. 2, p. 1698.
31. SCHMITZ, H. E., and TOWNE, J. E. Treatment of pelvic endometriosis. *Am. J. Obst. & Gynec.*, 1948, *55*, 583–590.
32. SCHWARZ, O. H. Discussion of Counseller.[4]
33. TELINDE, R. W., and RUTLEDGE, F. Culdoscopy, useful gynecologic procedure. *Am. J. Obst. & Gynec.*, 1948, *55*, 102–116.

DISCUSSION

DR. HOWARD B. HUNT, Omaha, Nebraska. We are all indebted to Dr. Portmann and Dr. Hays for this comprehensive analysis of 142 cases of endometriosis of which 34 have been irradiated with satisfactory control of symptoms in 97 per cent of cases. In the selection of cases for therapy, the radiologist must assure himself that, in the individual patient, symptomatic benefits promised by resolution of the ectopic endometrial tissue will definitely outweigh such disturbances as might be associated with the resulting irradiation menopause.

It would appear that, in women under forty, conservative surgery with removal of resectable endometrial implants is indicated before considering ovarian inactivation by irradiation. Ovarian inactivation by irradiation seems warranted in those cases in whom (a) surgery has failed to properly relieve symptoms, (b) involvement has extended to the sigmoid, bladder or rectum, and possibly (c) women over forty or women already sterile in whom clinical aspects or response to androgen therapy established a diagnosis of endometriosis and promise a satisfactory response from ovarian inactivation. Does Dr. Portmann feel that irradiation is warranted in this latter group of cases without previous surgical exploration and histopathological diagnosis? Roentgen therapy offers more dependable irradiation of the ovaries than radium therapy due to their variable displacement from intrauterine radium sources.

DR. PORTMANN (closing). Dr. Hunt suggests the term "inactivation of the ovaries," which is good advice. We have used the word "sterilization." "Castration" actually means removal of the gonads, therefore we should not speak of roentgen castration.

In regard to the criteria for inactivation of the ovaries for endometriosis by irradiation without previous surgical exploration or histopathologic diagnosis, androgens may be used to help establish the diagnosis. When androgens are administered there may be temporary relief of symptoms and then recurrence, which would be indicative of endometriosis. However, as I stated, the history and the physical findings are so characteristic in most of these patients experiencing severe difficulties, that I think we are justified in making the diagnosis of endometriosis on this basis.

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MALIGNANCY IN THE NEGRO

A STATISTICAL REVIEW

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ON PERUSING the literature one finds many conflicting statements about the parity or disparity of the statistics of malignancy as they are applied to the various races. Many of these statements are so paradoxical that obviously one is either totally wrong and the other correct or both contain some degree of inaccuracy. Sometimes these statements represent the opinions and findings of recent writers; oftentimes, however, they are merely the hang-over of earlier misconceptions. Accordingly it was felt that it would be not without profit to compile some statistics on the occurrence of malignancy in the Negro.

For the purpose of this paper, an arbitrary five year period between 1940 and 1944 was selected. During that period the total number of hospital admissions was 24,929. Of these there were 302 histopathologically proved cases of malignancy occurring in Negroes. This number represents 1.2 per cent of the total admissions at Provident Hospital. The percentage of cancer admissions (Fig. 1) during this period varied on a yearly basis from 1.6 per cent in 1940 down to 0.8 per cent in 1944.

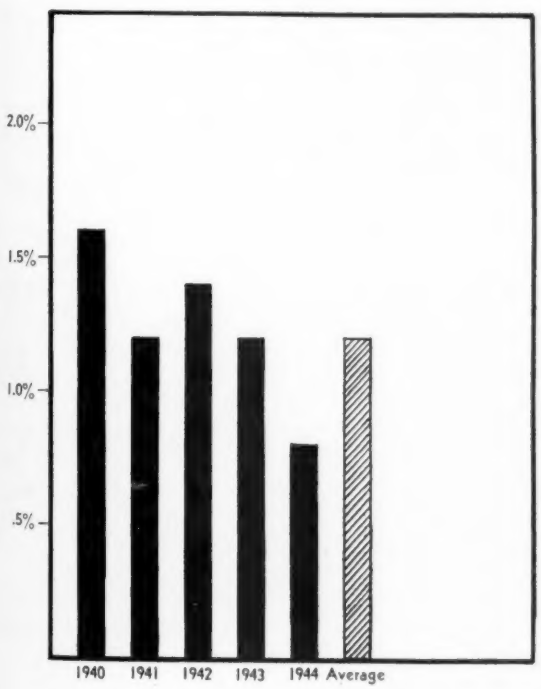

FIG. 1. Percentage cancer admissions to Provident Hospital, 1940–1944.

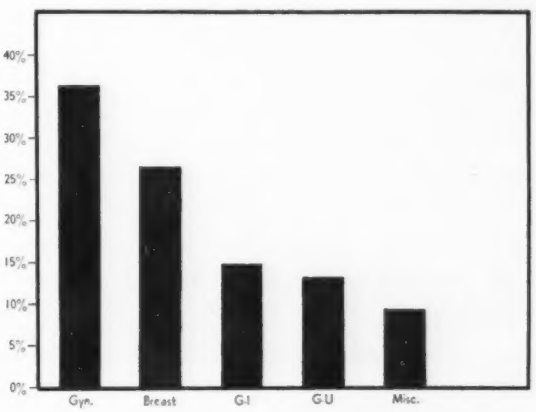

FIG. 2. Percentage distribution of lesions.

The total list of malignant cases was arbitrarily divided into five rather large groups. Of these, four represented the site or systems in which malignancy most commonly occurred and the fifth was a repository in which the infrequently occurring types of malignancy were bracketed. Thus, we have the cases divided and grouped into the categories of breast malignancy, malignancy of the female reproductive tract, cancer of the gastrointestinal tract, cancer of the genitourinary tract and miscellaneous cases of malignancy (Fig. 2). Of the total group, 80 cases, or 26.5 per cent, came

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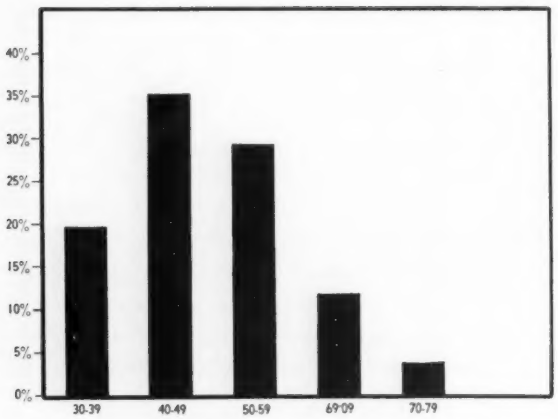

FIG. 3. Percentage breast cancer per decade.

under the heading of breast cancer; 110 cases (36.4 per cent) of cancer of the female reproductive tract were discovered; gastrointestinal malignancy was represented by 44 cases, or 15.6 per cent of the total; cancer of the genitourinary tract claimed 40 cases, or 13.2 per cent; and finally, 28 cases of malignancy, or 9.3 per cent of the original 302 cases, were placed in the miscellaneous group.

Breast. The average age of the patient in which malignancy of the breast developed was 49.4 years. The youngest case observed was in a thirty year old individual and the oldest patient was seventy-five years of age. Nineteen and six-tenths per cent of the 80 cases developed in the fourth decade, 35.3 per cent in the fifth decade, 29.4 per cent in the sixth decade, 11.8 per cent in the seventh decade, and 3.9 per cent in the eighth decade (Fig. 3). All of these lesions were carcinoma and all the patients were females with one exception. The position of over one-half of the lesions (Fig. 4) was the upper outer quadrant of the breast: 53.8 per cent of the neoplasms were found in this quadrant; 25.6 per cent in the lower outer quadrant; 12.8 per cent in the upper inner quadrant; and 7.8 per cent in the lower inner quadrant.

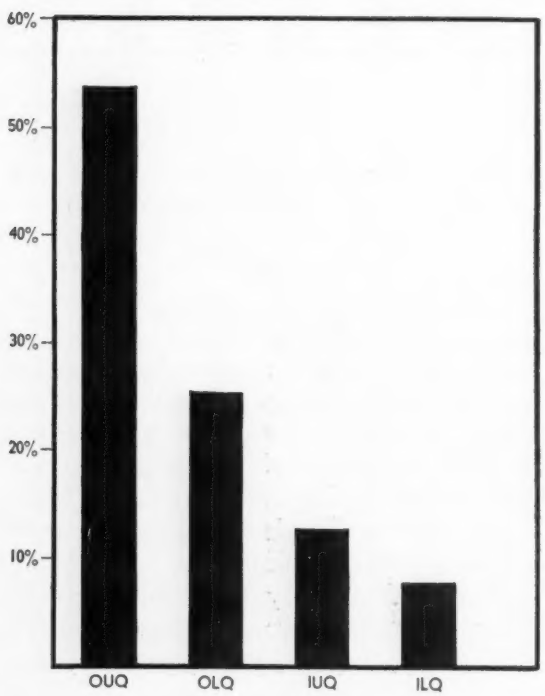

FIG. 4. Position of breast lesions.

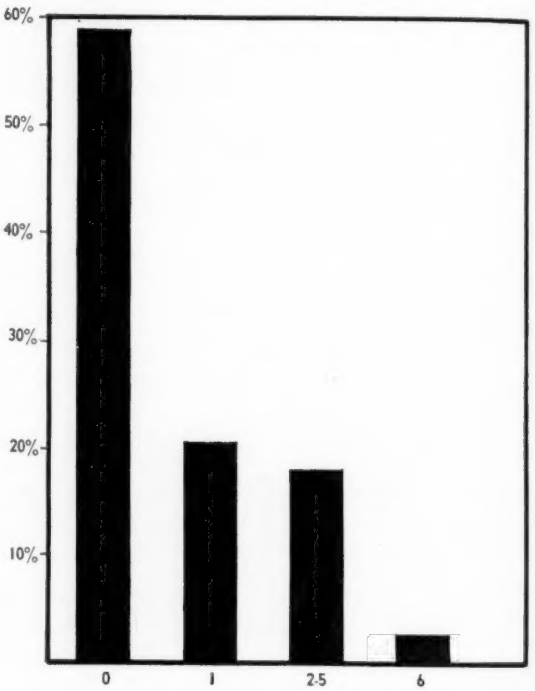

FIG. 5. Number of pregnancies in breast cases.

In conformity with the general statistical picture for malignancy of the breast (Fig. 5), 59 per cent of these patients had not been pregnant, 20.5 per cent had had only one pregnancy, 18 per cent had two to five pregnancies, and 2.5 per cent had six or more pregnancies.

Female Reproductive Tract. The average age of patients within this group was 49.1 years, with the youngest patient being twenty-six and the oldest patient eighty-three years of age. Three and one-tenth per cent of the total

of 110 cases occurred in the third decade, 18.8 per cent in the fourth decade, 34.8 per cent in the fifth decade, 20.3 per cent in the sixth decade, 17.2 per cent in the seventh decade, 4.6 per cent in the eighth decade, and 1.2 per cent in the ninth decade (Fig. 6). Thus we see, as in the case of breast malignancy, over three-fourths of all the malignancies occurring in the female reproductive tract developed after the fortieth year of age.

Of the 110 cases reported (Fig. 7) by far the largest number (79) was found in the cervix. These 79 cases represented 71.8 per cent of the total number. All 79 cases were carcinomatous lesions. The next largest group of neoplasms was found in the uterus, where there were 16 cases, or 14.6 per cent of the total. Of these, 14 were carcinoma and 2 sarcomatous degeneration of leiomyofibromas. There were 10 cases

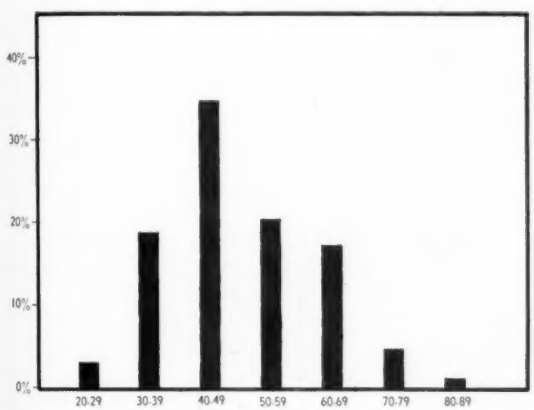

Fig. 6. Percentage female reproductive cancer per decade.

of carcinoma of the ovaries representing 9.1 per cent of the original 110 cases. The remaining 5 cases were divided between the vulva and vagina, 4 (3.6 per cent) being located in the former, and 1 (0.9 per cent) in the latter.

Thus, we see that cancer of the female reproductive tract has a very prominent position in the picture of malignancy. Cervical lesions alone represented 26.2 per cent of this entire series of 302 cases. Many authors group cervical lesions together with those of the corpus of the uterus. Under such a consideration, uterine cancer would then represent 31.5 per cent of this series.

Twenty patients with cervical lesions had no pregnancy. This number represented 25.3 per cent of the total. Twenty-three patients, or 29.1 per cent, had one pregnancy and 36 pa-

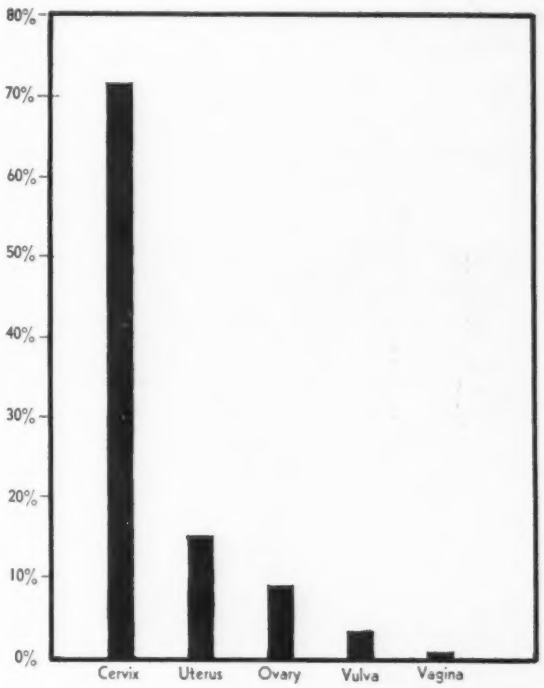

Fig. 7. Distribution of lesions in female reproductive tract.

tients, or 45.6 per cent, had two or more pregnancies. In other words, three-fourths of these patients had had at least one pregnancy. It is conceivable that this figure might be even larger if a complete history of abortions had been obtained in all cases and correlated with the number of pregnancies. Thus, the incidence of abortion as correlated with carcinoma of the cervix may well prove an interesting problem to be worked out in the future.

Gastrointestinal Tract. Gastrointestinal le-

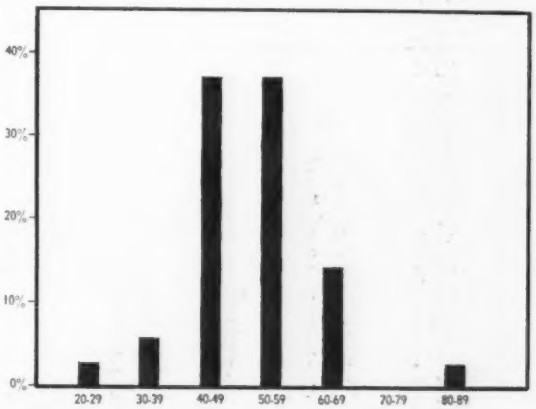

Fig. 8. Percentage gastrointestinal cancer per decade.

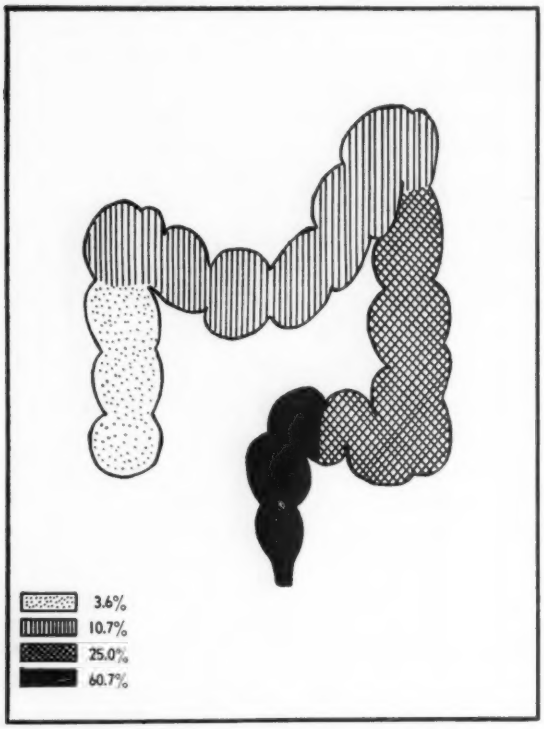

Fig. 9. Distribution of lesions of the colon.

sions, as stated above, comprise 14.6 per cent of the 302 cases. In this group, lesions of the mouth and oropharynx have been arbitrarily, excluded while those of the pancreas, liver and gallbladder, organs of digestion, have been included.

The average age of these patients was 51.2 years, the oldest being eighty-five and the youngest twenty-four. Two and nine-tenths per cent of gastrointestinal neoplasms occurred in the third decade, 5.7 per cent in the fourth, 37.1 per cent in the fifth, 37.1 per cent in the sixth, 14.3 per cent in the seventh, none in the eighth and 2.9 per cent in the ninth decade (Fig. 8).

Of the total of 44 cases, 24, or 54.5 per cent, were males and 20, or 45.5 per cent, were females. Two males, or 4.5 per cent of the total, had carcinoma of the esophagus. There were 8 cases of gastric malignancy equally divided between the sexes. No cases were found in the small intestine during this five year period. The large intestine showed a marked preponderance of lesions, with 28 cases, or 63.7 per cent, of all gastrointestinal malignancy. Of these 28 cases, 17 were found in males. Two anal and 3 pancreatic carcinomas were found in women. One male had a primary carcinoma of the liver and no malignancy was found in the gallbladder (Table I).

Table I

Distribution of Gastrointestinal Cancer

Site	Number	Per Cent	Male	Female
Esophagus	2	4.5	2	0
Stomach	8	18.2	4	4
Small intestine	—	—	—	—
Large intestine	28	63.7	17	11
Anus	2	4.5	0	2
Pancreas	3	6.8	0	3
Liver	1	2.3	1	0

Table II

Distribution of Genitourinary Cancer

Site	Number	Per Cent	Male	Female
Kidney	2	5	2	0
Ureter	0	0	0	0
Bladder	10	25	6	4
Prostate	22	55	22	—
Penis	6	15	6	—
Testicle	0	0	0	—

Because lesions of the large intestine were so numerous, it was considered profitable to subdivide them according to location. As may be seen in Figure 9, 3.6 per cent of the cases were in the cecum and ascending colon, 10.7 per cent in the transverse colon, 25.0 per cent in the sigmoid and 60.7 per cent in the rectum.

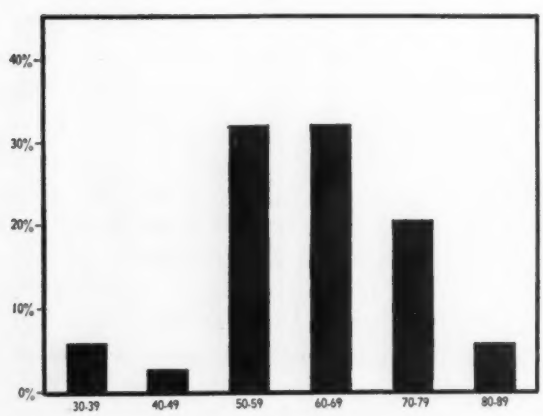

Fig. 10. Age incidence of genitourinary cancer.

Of the rectal carcinomas, 9 were found in females.

Genitourinary Tract. The mean age for patients in this group was 61.4 years and the age range was from thirty-two to eighty-two. Five and nine-tenths per cent of the lesions occurred during the fourth decade, 2.9 per cent during the fifth decade, 32.4 per cent in both the sixth and seventh decades, 20.5 per cent in the eighth decade and 5.9 per cent in the ninth decade (Fig. 10).

Thirty-six of these patients (90 per cent) were males and only 4 were females.

From Table II can be seen the distribution of the genitourinary lesions. Most of the cases (22) were primary in the prostate. Of the 10 cases of carcinoma of the bladder, 4 were females. In addition there were 6 cases of penile carcinoma. No cases of malignancy were found in the ureters or testes.

Miscellaneous. The miscellaneous group may best be studied by perusing Table III. Here we find that there were 7 lesions of mesenchymal origin (bone, connective tissue, and reticulo-endothelial system). The skin had 10 lesions, of which 8 were squamous cell carcinomas and 2 were malignant melanomas; 5 cases were found in the mouth and oropharynx, 1 in the thyroid, 1 lymphosarcoma of the eye, 2 bronchogenic carcinomas of the lung and 2 Hodgkin's disease which were apparently mediastinal in origin.

TABLE III

DISTRIBUTION OF OTHER LESIONS

Site	Types	Age Range yr.	Male	Female
Bone	Chondrosarcoma	53	1	0
Connective tissue	Adamantinoma	28	0	1
Reticulo-endothelial	Fibrosarcoma	16–44	0	3
	Neurofibrosarcoma	22	0	1
	Reticulum cell sarcoma	7	1	0
Skin	Squamous cell carcinoma	31–64	3	5
	Malignant melanoma	50–62	1	1
Mouth and Oropharynx	Mixed tumors	55–56	0	2
	Squamous cell carcinoma	44–53	2	1
Thyroid	Adenocarcinoma	56	0	1
Eye	Lymphosarcoma	75	0	1
Thorax	Bronchogenic carcinoma of lung	46–52	1	1
	Hodgkin's disease	27–47	2	0

DISCUSSION

As one peruses the foregoing figures, a number of interesting points become apparent. The first and most striking point is the obvious similarity between these figures and those compiled for the United States at large. Within reasonable limits there is also parity between the preceding statistics and those quoted for many European nations whose populations are, for all practical purposes, entirely Caucasian. There are, however, a few discrepancies, some apparent and some real; therefore, let us investigate the various findings collectively.

As we have seen, the most frequently occurring malignancy in this series was found in the female reproductive tract with breast malignancy second, gastrointestinal malignancy third, and genitourinary neoplasia fourth. In general, it may be observed that malignancy in the female reproductive tract and breast cancer occupy a somewhat

more important position among Negroes than among the total population. This, of necessity, forces gastrointestinal and genitourinary cancer to occupy less significant positions. The most important factor in the production of this discrepancy is the abnormally high incidence of uterine cancer, particularly carcinoma of the cervix. According to Willis,[7] mammary cancer is generally the most frequent cause of death in female cancer victims and in relation to uterine cancer holds almost a 2:1 ratio. In this series, however, uterine malignancy surpasses breast cancer 95 cases to 80. Thus the ratio is better than 1:1 with the preponderance in favor of uterine lesions. This is probably not due to a dearth of mammary disease since the number of cases in this series is in keeping with over-all statistics. It is due, however, to an incidence of uterine cancer out of all due proportion with other statistics. The first question which arises is whether this finding is peculiar to the present series alone. The answer to this is apparently negative inasmuch as Quinland and Cuff[3] reported comparable findings in a similar series nine years ago. As a result, the conclusion which must be drawn is that this excess of uterine cancer is due either directly or indirectly to race. It is doubtful that the former is the case and there is reason to support this contention.

In the first place, preponderance of uterine cancer has not always been peculiar to the Negro. Up to approximately twenty years ago there was a similar preponderance of cervical malignancy in Caucasians and the incidence of uterine cancer was higher that that in the mammary gland. Now the gradual reversal of the ratio in the past two decades is obviously not due to any inherent racial characteristic; consequently, some other factor must be found to explain the change.

The most likely cause of this change appears to be concerned with pregnancy. Since the beginning of the twentieth century, there has been a gradual decrease in the size of the average white American family. This, of course, means fewer pregnancies per individual mother. Any reduction in pregnancies, according to present day theories, would necessarily bring about an increase in mammary gland carcinoma with a corresponding decrease in cervical carcinoma. A further aid to the decreased incidence of cervical carcinoma is the vast improvement in obstetrical techniques which occurred after the turn of the century.

The Negro female, on the other hand, has only comparatively recently shown a tendency toward a reduction in pregnancies. Also, she was, in general, unable to enjoy

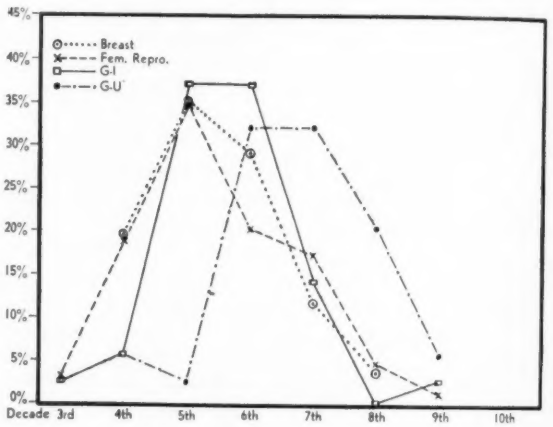

FIG. 11. Comparative age incidence of various systems.

improved obstetrical techniques until long after the white mother. These factors militated against any change in the mammary gland, uterine ratio. Since the appearance of these influences among Negroes, there is an apparent tendency toward a change in this ratio and it is felt safe to predict that in ensuing years there will be a marked change. The conclusion drawn, therefore, is that, while there does exist some disparity in statistics, under similar conditions over a reasonable period of time the figures would be comparable. Furthermore, as the number of cervical malignancies decreases there will be a relative increase in gastrointestinal and genitourinary lesions.

As has often been noted, the highest incidence of cancer occurs after the fifth

decade. A comparative study of the groups in this series reveals that these cases conform to the pattern. A graph (Fig. 11) shows that the peaks of the curves occur in the fifth decade for malignancies of the breast and the female reproductive system. The peak of the curve for gastrointestinal cancer is somewhat flatter due to an equality of distribution between the fifth and sixth decades. In like manner, the peak of the curve for genitourinary cancer lies between the sixth and seventh decades. These findings indicate that most cancers in the latter two groups occur in older individuals than do other malignancies, and, further, that genitourinary cancer occurs latest in life. These conclusions have been reiterated many times following previous statistical studies.

In regard to cancer of the breast, the position of the lesion is important with respect to prognosis. Repeated studies have shown that most neoplasms occur in the upper outer quadrant with the upper inner, lower outer, and lower inner quadrants following in order as sites of predilection. The present series, however, shows a discrepancy with the accepted order in that the lower outer quadrant has taken precedence over the upper inner quadrant. No explanation of this fact is forthcoming. It may be accidental but this is merely a conjecture which can be neither proved nor disproved until such time as a larger series is compiled.

One fact which impresses itself on the reviewer is the marked predominance of malignancy in the Negro female in comparison to the male. Not only does breast pathology and pathology of the female reproductive system take up over 60 per cent of this series, but also female malignancy plays a large part in gastrointestinal cancer and in the 28 miscellaneous cases of which 17 were women.

In gastrointestinal malignancy men reportedly have a higher incidence in the ratio 2 or 3:1. The present series shows a slightly better than 1:1 ratio for men. For example, of the 17 cases of cancer of the rectum 9 were found in women. This represents a complete reversal of all previous findings.

The most interesting feature about the miscellaneous cases was the collection of 8 skin cancers. Carcinomas of the skin are relatively rare in Negroes, presumably because of the pigmentation in the skin. These 8 cases of squamous cell carcinoma do not at all disprove that contention but do warn the clinician that he must be aware of the possibility of their occurrence. The 2 malignant melanomas were a rare and inexplicable occurrence. That 2 such cases occurred in a series of this size must have been purely accidental.

Finally, it must be noted that in this entire series there were no cases of malignancy in the larynx, the nasal and paranasal cavities, the thymus, the adrenal cortex, the parathyroid glands or the cerebrum. This does not tend to show their nonexistence but rather the limitations of a series of this size.

SUMMARY

A statistical review of 302 cases of malignancy in the Negro has been presented. It has been found that malignancy behaves much the same in Negroes as in other races under comparable situations and in similar environments. The only apparent exception to this conclusion is the fact that the predominance of malignancy in females is more marked in Negroes than in Caucasians.

The author wishes to express his appreciation to Doctor William P. Quinn, Miss Vivian Headen and Mr. Morris Butler for their patient cooperation in the compilation of this paper.

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REFERENCES

1. Novak, E. Gynecological and Obstetrical Pathology. 1941.
2. Pack, G. T., and LeFevre, R. G. Age and sex distribution and incidence of neoplastic diseases at Memorial Hospital, New York City, with comments on "cancer ages." *J. Cancer Research*, 1930, *14*, 167–294.

3. QUINLAND, W. S., and CUFF, J. R. Primary carcinoma in Negro; anatomic distribution of 300 cases. *Arch. Path.*, 1940, *30*, 393–402.
4. SORSBY, M. Cancer and Race: The Incidence of Cancer among Jews. John Bale Sons & Danielsson, Ltd., London, 1931.
5. WELLS, H. G. Cancer statistics as they appear to a pathologist, *J.A.M.A.*, 1927, *88*, 399–403; 476–482.
6. WELLS, H. G. Nature and etiology of cancer. *Am. J. Cancer*, 1931, *15*, 1919–1968.
7. WILLIS, R. A. Pathology of Tumors. Butterworth & Co., Ltd., London; C. V. Mosby Company, St. Louis, 1948.

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PHYSICAL MEASUREMENTS ON VARIOUS BETA-RAY APPLICATORS*

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INTRODUCTION

BETA-RAY applicators for treatment of superficial conditions of the eye have been found to be beneficial and applicators using radon[2,5,9,10,14,15,17,18,20,21] or radium element[1,9,11,14,16,20] have been used for some years. Radioactive phosphorus[12] was used in 1946 and the Ra D+E applicator was introduced in 1948.[4,22,23] More recently other applicators which have definite advantages* have been developed. Among these are applicators using Sr^{90},[7,8] and Ru^{106}.

Owing to the prospect of the continued use of the above types of beta-ray applicators, a series of physical measurements has been made to determine the respective dosages delivered by various sample applicators at depths from 0 to 5 mm. in tissue phantom. The results of these measurements are presented here to permit a reasonable evaluation of previous dosage data and to contribute to a more substantial basis for future beta-ray treatment. Most previous dosage factors were arrived at by empirical methods, and have generally been given in terms of millicurie-seconds in the case of radon applicators, milligram minutes for radium applicators, or in varying treatment times for other permanent applicators such as the Ra D+E.[24] Very little information is available concerning true dosage rates; however, Blomfield and Spiers[3] and Neary[13] published in 1946 the results of dosage measurements on beta-ray plaques in which they specify the dosages in terms of roentgens or roentgen equivalents. These plaques differ considerably in physical size and construction from applicators considered in this paper and thus cannot be readily compared. The present data have been used to state dosages for all applicators in terms of a common unit, the rep† or roentgen equivalent. Owing to physical differences in amount and distribution of active material in individual applicators, the rep output data given in this paper necessarily will not hold for other applicators. The depth dose data, however, will be correct for applicators with like active areas and filtration.

* Properties which are considered to be advantageous are long half-life, absence of gamma radiation, and appropriate penetration.

APPLICATORS

Measurements were made upon five different types of applicators—radon, radium element, radium D+E, strontium and ruthenium. The physical properties of the different applicators are given in Table 1. The beta rays mentioned in columns 6 and 7 are those which are present in significant amounts and which have energies great enough to contribute to the radiation dosage. The active areas of the applicators vary, but in general are about 6 to 8 mm. in diameter with the exception of the radon applicators all of which measure about 5 mm.

MEASUREMENTS

Dosage measurements were made using an extrapolation ionization chamber which is a modified version of the type described by Failla.[6] The chamber was adapted to measure each applicator with as little additional filtration as possible in order to obtain an accurate surface dosage. The

† The rep (roentgen equivalent physical) is that quantity of corpuscular radiation which produces in tissue per gram of tissue, ionization (energy dissipation) equivalent to the quantity of ionization (energy dissipation) for one roentgen of gamma or roentgen radiation in air. The ionization of one electrostatic unit (e.s.u.) per cc. at standard conditions is referred to in this paper as one rep.

* Work performed under Contract No. W-31-109-eng-78 between Western Reserve University and the U. S. Atomic Energy Commission.

TABLE I

PHYSICAL PROPERTIES OF APPLICATORS

Applicator	Content (mc.)	Inherent Filtration		Principal Beta Rays[19]			Source of Applicator
		mm.	mg./cm.^{2}	Half-life	Isotope	Peak energy (mev.)	
1	2	3	4	5	6	7	8
Rn A	100						1
Rn B	102						1
Rn C	150	0.1 glass	30	3.825 days	RaB	0.65	1
Rn D	346				RaC	3.15	1
Rn E	365						1
Radium Element	25 mg.	0.1 mg.	17.4	1,590 years	RaC	3.15	2
RaD+E No. 1	10	0.05 Al	13.5	22 years	RaE	1.17	3
RaD+E No. 2	10	0.1 mg.	17.4				2
$Sr^{90}-Y^{90}$ No. 1	5–10	0.25 lucite 0.25 Al	36 67	25 years	Sr^{90} Y^{90}	0.61 2.32	4
$Sr^{90}-Y^{90}$ No. 2	18.6	0.001 inch steel	20	25 years			5
$Ru^{106}-Rh^{106}$	10	0.25 Al	67	1.0 year	Ru^{106}	3.55	4

Sources: 1. University Hospitals of Cleveland, Ohio.
2. H. S. Swanberg, M.D., Quincy, X-ray and Radium Laboratories, Quincy, Ill.
3. O. Glasser, Ph.D., Cleveland Clinic, Cleveland, Ohio.
4. Western Reserve University, Atomic Energy Project.
5. Tracerlab, Inc.

same chamber was used to measure depth dosages from 1 mm. to 5 mm. by placing the appropriate thickness of phantom between the applicator and chamber. Lucite was used as the tissue phantom. It has a density of 1.14 gm/cm.^{3} and does not differ too widely from tissue in electron density. Saturation backscattering was obtained by using a collecting electrode (lucite) 1 inch thick.‡

The measurements consisted of determining ionization current in electrostatic units per cubic centimeter in a vanishingly thin air chamber of 3.9 mm. diameter which had its axis coincident with the axis of the applicator. Thus the measurements constitute an average dosage over the central 3.9 mm. of the applicator. The rep output measurements were repeated at various times with modified chambers and, except for the radon applicators, did not vary by more than 5 per cent. Such variations are to be expected, since no corrections for temperature and pressure were made. The depth dose curves plotted from these repeated measurements did not vary by more than 1 per cent for a given applicator.

The data obtained as the result of measurements of radon applicators are shown in Table II. This table gives the dosage values for five radon applicators at depths from 0 mm. (surface dose) to 5 mm. in tissue phantom.§ The doses are expressed

‡ Some of the earlier measurements made with a thin (1/16 inch) collecting electrode are included in this report. Using this collecting electrode saturation backscattering was not always achieved. This was especially true when measuring radon applicators, due to the presence of gamma radiation. Actually the results for the pure beta-ray applicators measured with this thin plate did not differ appreciably from those made with the 1 inch plate.

TABLE II

RADON APPLICATOR DATA

Depth		0 mm.		1 mm.		2 mm.		3 mm.		4 mm.		5 mm.	
Applicator	Content (mc.)	Dose (rep/sec.)	rep/sec/mc.	Dose (rep/sec.)	rep/sec/mc.	Dose (rep/sec.)	rep/sec/mc.	Dose (rep/sec.)	rep/sec/mc.	Dose (rep/sec.)	rep/sec/mc.	Dose (rep/sec.)	rep/sec/mc.
A*	100	19.5	0.1950	2.62	0.0262	1.1	0.0110	0.48	0.0048	0.29	0.0029	0.16	0.0016
B*	102	17.6	0.1725	3.81	0.0373	1.63	0.0160	0.76	0.0074	0.38	0.0037	0.24	0.0023
C	150	76.8	0.5120 (+26.1)	13.0	0.0866 (−10.0)	4.75	0.0317 (−5.6)	1.61	0.0107 (−25.7)	0.87	0.0058 (−19.5)	0.51	0.0034 (−17.1)
D	346	51.5	0.1485 (−63.4)	24.95	0.0721. (−25.0)	9.78	0.0283 (−15.8)	5.00	0.0144 (0.0)	2.36	0.0068 (−5.6)	1.37	0.0040 (−2.5)
E	365	146.8	0.4040 (−0.5)	40.5	0.111 (+15.4)	15.3	0.0419 (+24.7)	6.58	0.0180 (+25.0)	3.25	0.0089 (+23.6)	1.81	0.0050 (+22.0)
E′	212	111.7	0.5270 (+29.8)	25.8	0.1217 (+26.5)	7.58	0.0358 (+6.5)	3.25	0.0153 (+6.2)	1.61	0.0076 (+5.5)	0.92	0.0043 (+4.9)
E″	103	32.4	0.3150 (−22.4)	8.28	0.0804 (−16.4)	2.93	0.0284 (−15.4)	1.28	0.0124 (−13.9)	0.66	0.0064 (−11.1)	0.37	0.0036 (−12.2)
Mean C, D, E E′ and E″			0.4060		0.0962		0.0336		0.0144		0.0072		0.0041

* Applicators A and B measured with 1/16 inch thick collecting electrode. See footnote ‡
Note: Figures in parentheses indicate percentage deviation from the mean.

in rep/sec. and also in rep/sec. per mc., the latter being determined from gamma-ray measurements. A mean was obtained for each of the depths for the rep/sec/mc. values for applicators C, D, and E, all of which were measured using a 1 inch thick electrode. The percentage deviation from the mean was then calculated for each applicator at each depth and is indicated in parentheses under the rep/sec/mc. value. Depth dose curves for all of the radon applicators are shown in Figure 1.

Table III includes the data obtained for the other types of applicators measured. In this table are given the dosages in rep/sec. at various depths as well as the percentage of surface dose obtained at each of these depths. Depth dose curves for these applicators are shown in Figure 2.

In addition to the above data, a photograph is shown of the forearm of an individual upon whom a skin erythema test

§ Applicator E was measured under like conditions at three different times in order to determine the constancy of depth dose from one applicator.

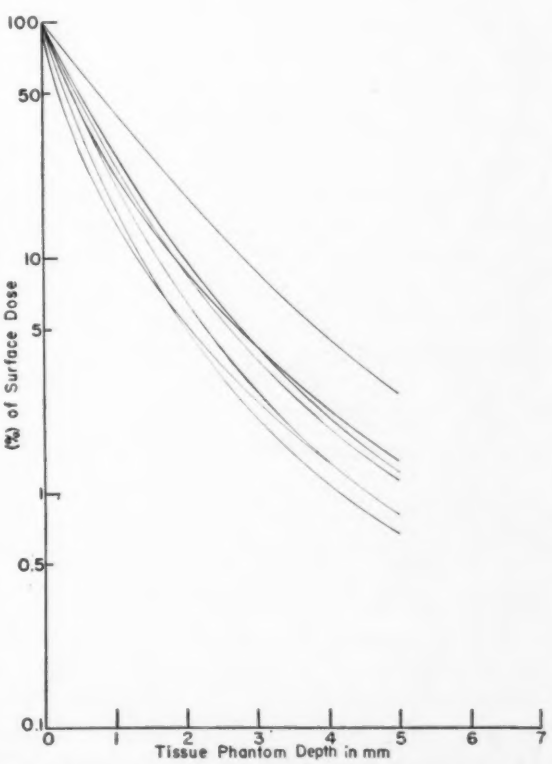

FIG. 1. Depth dose curves for radon applicators.

TABLE III

RA, SR, RAD+E, AND RU DATA

Applicator	Depth											
	0 mm.		1 mm.		2 mm.		3 mm.		4 mm.		5 mm.	
	Dose (rep/sec.)	Per cent of surface dose	Dose (rep/sec.)	Per cent of surface dose	Dose (rep/sec.)	Per cent of surface dose	Dose (rep/sec.)	Per cent of surface dose	Dose (rep/sec.)	Per cent of surface dose	Dose (rep/sec.)	Per cent of surface dose
1	2	3	4	5	6	7	8	9	10	11	12	13
Radium Element	40.1	100	6.78	16.9	3.16	7.6	1.47	3.7	0.72	1.8	0.42	0.96
RaD+E No. 1	8.55	100	0.88	10.2	0.079	0.92						
RaD+E No. 2	15.7	100	1.52	9.7	0.16	1.02						
Sr^{90} No. 1	5.12	100	2.10	41.0	0.90	17.6	0.38	7.4				
Sr^{90} No. 2	32.4	100	13.3	41.1	6.23	19.2	2.94	9.1	1.23	3.8	0.40	1.2
Ru^{106}	5.72	100	3.14	54.8	1.73	30.4	0.97	16.9	0.58	10.1	0.32	5.6

was made. Applications of 500, 1,000 and 1,500 roentgens or reps were given by three different means—superficial roentgen rays (44 kv., half-value layer 0.24 mm. Al), Sr^{90} applicator No. 2, and the Ru^{106} applicator. This test was run to check the accuracy of measurements as well as to observe the relative effects of the three means of irradiation.

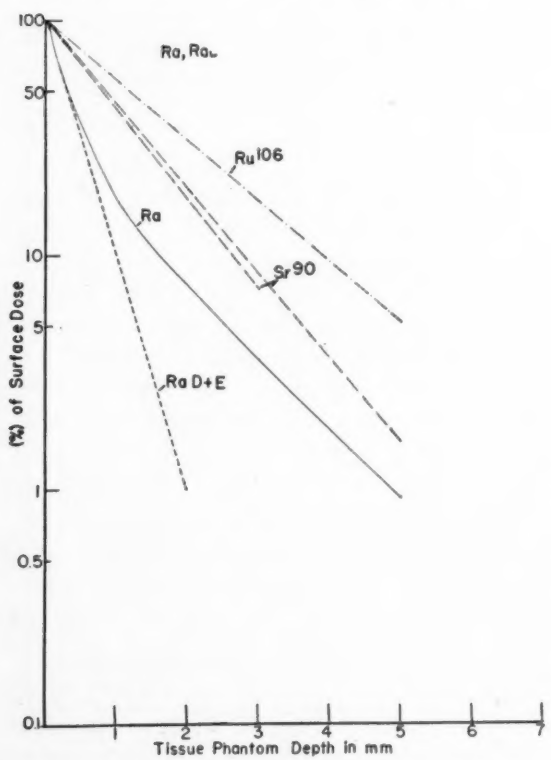

FIG. 2. Depth dose curves for Ra, Ra D+E, Sr^{90} and Ru^{106} applicators.

DISCUSSION OF RESULTS

It was anticipated prior to the making of these measurements that the dosage per millicurie from radon applicators might vary considerably due to such factors as thickness and active size of the applicators. This fact was borne out by the measurements, and, surprisingly, appears to be true even when measuring the same applicator at various times a few days apart. An examination of the data reveals that for all but the surface level, the dose per millicurie can be predicted to within approximately ± 25 per cent for applicators similar to those measured. In view of the foregoing, it is apparent that if one wishes to obtain adequate duplication of dosage using radon applicators, care must be taken to control such factors as size and thickness of the glass container. Actually it would be

advantageous to measure the output of such applicators prior to use by means of a suitable ionization chamber if such instrument could be made available. It is because of these difficulties that applicators such as those included in Table III and Figure 2 hold a particular advantage over the radon applicators. These relatively permanent types have been measured at varying times with a resulting variation of less than 5 per cent which is within the estimated experimental error. A comparison of these "permanent" types of applicators can be made by considering them in relation to the previously mentioned advantages—long half-life, absence of gamma radiation, and satisfactory penetration of the beta-ray particle.

With respect to half-life, all of the applicators in Table III are adequate; however, the value of 1.0 year for Ru^{106} necessitates the re-evaluation of rep output monthly or possibly more often. The Sr^{90} and Ra D+E applicators are free of significant amounts of gamma radiation while the Ru^{106} and radium element applicatiors emit objectionable quantities which require precautionary measures.‖

The character of the depth dose curves for the various "permanent" applicators varies considerably. These variations can be used to advantage in choosing an applicator, which may, by virtue of its depth dose curve, possess definite advantage in treatment of lesions at a particular depth. In order of increasing penetration, we have first Ra D+E for which the dose after 2 mm. is less than 1 per cent of the surface dose, next radium element and Sr^{90} which have essentially the same distribution as radon, and last Ru^{106} for which the dosage is still above 5 per cent at 5 mm. depth.

The above comparison indicates that each of the "permanent" applicators has a particular advantage which may be useful therapeutically. For most clinical uses the strontium applicator, with its long half-life and absence of gamma radiation, appears to hold a slight advantage over the others.

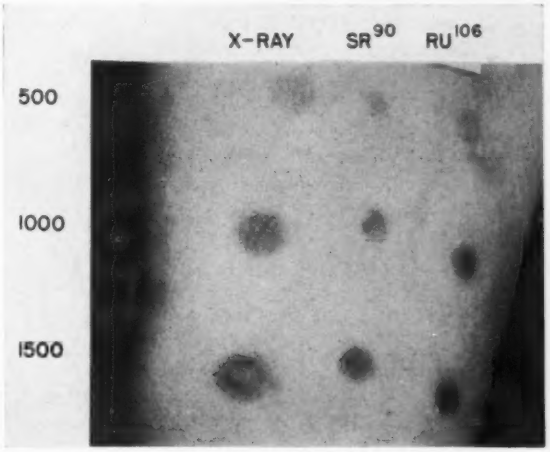

Fig. 3. Skin erythemas produced by Sr^{90} and Ru^{106} applicators and the Philips 44 kv. roentgen-ray unit. Dosages are 500, 1,000 and 1,500 r or rep.

The skin test comparing the effects of the Sr^{90} and Ru^{106} applicators and the 44 kv. superficial roentgen therapy unit provides a check upon the accuracy of beta-ray dosage measurements in roentgen equivalents. It may be seen from Figure 3 that the reactions obtained from the three radiation sources are indistinguishable at several dosage levels. This is reassuring since it offers a direct biological comparison between the roentgen as measured with a calibrated thimble chamber and the rep as used in this paper.

SUMMARY

The results of ionization measurements on various beta-ray applicators are presented. A comparison of the applicators is made based upon these measurements and other physical factors. Depth dose curves are shown for each applicator. The result of a biological comparison of experimental

‖ It should be mentioned that even in the absence of nuclear gamma radiation, the energetic beta rays emitted from all of these applicators are accompanied by varying amounts of *Bremstrahlung* resulting from the interaction of the beta rays with the metal shells of the applicators.

applicators and a superficial roentgen-ray unit is included.

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REFERENCES

1. Bowing, H. H., and Fricke, R. E. Radium treatment of vernal conjunctivitis. Am. J. Roentgenol. & Rad. Therapy, 1937, *38*, 740–742.
2. Burnam, C. F., and Neill, W., Jr. Use of beta ray of radium applicator; description of methods and results obtained in superficial lesions of eye. *South. M. J.*, 1940, *33*, 279–286.
3. Blomfield, G. W., and Spiers, F. W. Dose measurement in beta-ray therapy. *Brit. J. Radiol.*, 1946, *19*, 349–356.
4. Caldemeyer, E. S. Radium-D applicator in ophthamology. *Mississippi Valley M. J.*, 1948, *70*, 240–241.
5. Failla, G., Adair, F. Quimby, Edith H., Sugiura, K., Arnell, J. C. and Goldsmith, N. W. Dosage study relative to therapeutic use of unfiltered radon. Am. J. Roentgenol. & Rad. Therapy, 1926, *15*, 1–35.
6. Failla, G. Measurement of tissue dose in terms of same unit for all ionizing radiations. *Radiology*, 1937, *29*, 202–215.
7. Friedell, H. L., Thomas, C. I., and Krohmer, J. S. Beta-ray application to eye; with description of applicator utilizing Sr^{90} and its clinical use. *Am. J. Ophth.*, 1950, *33*, 525–533.
8. Friedell, H. L., Thomas, C. I., and Krohmer, J. S. Description of Sr^{90} beta-ray applicator and its use on eye. Am. J. Roentgenol. & Rad. Therapy, 1951, *65*, 232–244.
9. Hughes, W. F., Jr., and Iliff, C. F. Beta irradiation of eye. *Am. J. Ophth.*, 1949, *32*, 351–360.
10. Iliff, C. E. Beta irradiation in ophthamology. *Arch. Ophth.*, 1947, *38*, 415–441.
11. Iliff, C. E. Beta ray radium applicator for ocular use. *Arch. Ophth.*, 1947, *38*, 827–830.
12. Low-Beer, B. V. A. External therapeutic use of radioactive phosphorus. *Radiology*, 1946, *47*, 213–222.
13. Neary, G. J. Dose measurements with radium beta-ray applicators. *Brit. J. Radiol.*, 1946, *19*, 357–367.
14. Pendergrass, E. P., and Andrews, J. R. Radium emanation treatment of vernal catarrh. Am. J. Roentgenol. & Rad. Therapy, 1935, *34*, 637–640.
15. Quick, D. Radium in vernal catarrh. *Arch. Ophth.*, 1930, *4*, 212–219.
16. Robinson, G. A. Benign lesions of eye, ear, nose, and throat. Am. J. Roentgenol. & Rad. Therapy, 1935, *33*, 801–802.
17. Ruedemann, A. D. Beta radium in treatment of corneal lesions. *Arch. Ophth.*, 1947, *38*, 556–562.
18. Ruedemann, A. D. Beta radiation therapy. *Arch. Ophth.*, 1949, *41*, 1–4.
19. Seaborg, G. T., and Perlman, I. Table of isotopes. *Rev. Mod. Phys.*, 1948, *20*, 585–667.
20. Stallard, H. B. Effects of radium emanations in certain selected diseases of eye. *Tr. Ophth. Soc. U. Kingdom*, 1933, *53*, 224–238.
21. Stenstrom, W. K., Burch, E. P., and Walsh, F. M. Beta irradiation in ophthamology. *Journal-Lancet*, 1941, *61*, 69–72.
22. Stevenson, W. Ophthalmic applicator for beta radium-D. *Mississippi Valley M. J.*, 1948, *70*, 242.
23. Swanberg, H. New ophthalmologic applicator for pure beta irradiation utilizing radium "D" (preliminary report). *Mississippi Valley M. J.*, 1948, *70*, 71–72.
24. Swanberg, H. Radium-D ophthalmic applicator treatment time. *Mississippi Valley M. J.*, 1949, *71*, 93–94.

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SECONDARY ALTERATIONS OF THE FRONTAL SINUS IN CANCER OF THE PARANASAL SINUSES*

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DURING an analysis of roentgenograms from patients treated for cancer of the paranasal sinuses in this department, an interesting observation has been made on frequent secondary changes in the frontal sinus margins. In passing, it should be stated that in most of our patients the cancer was in a very advanced stage which could not lead to a good cure rate. The same circumstance may play a role in the frequency of these secondary changes in the frontal sinus margins which are not adequately discussed in the available literature.

The secondary alterations of the frontal sinus in primary cancer of the other paranasal sinuses can be grouped in three categories:

(1) Irregular opacity within the cavity of the sinus, consistent with a secondarily invading tumor. This is a rare roentgenologic finding. It can be difficult at times to differentiate it from the homogeneous haziness of the sinus produced by obstructive congestion or by secondary infection.

(2) A relatively uncommon finding is the secondary infiltrative destruction of the wall of the frontal sinus. In the reviewed series we had but one case (Fig. 1). This alteration must be differentiated from the primary carcinoma of the frontal sinus (Fig. 2). In this case the other sinuses remained intact, and the cancer gradually invaded the bony walls of the orbit, of the anterior fossa and of the forehead.

(3) The present discussion deals with a a third type of alteration alone in which the bony change is restricted to the margins of the sinus and to its immediate bony surrounding. In our material this alteration was found most frequently and, accordingly, will be discussed in detail.

MATERIAL

During the past ten years our department has treated 65 cases of paranasal cancer with roentgen therapy. Among these the last mentioned roentgenologic alteration of the wall of the frontal sinus

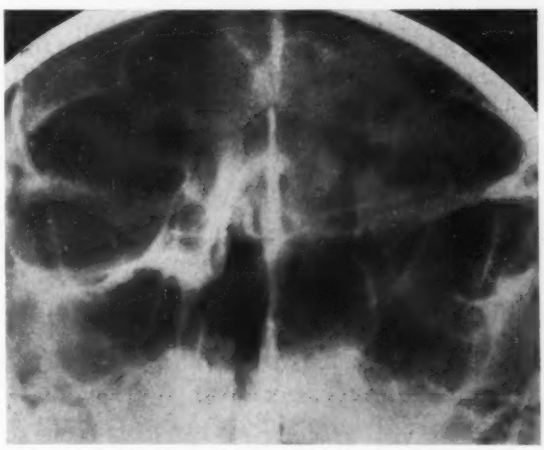

FIG. 1. Direct infiltrative destruction of the posterior wall of the left frontal sinus. Epidermoid carcinoma of the left antrum with invasion into the ethmoids, orbit, and nasal cavity.

FIG. 2. Primary epidermoid carcinoma of the right frontal sinus, invading the frontal bone, orbit, and base of the anterior fossa.

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Fig. 3. Initial disappearance of the white line in a short medial section of the upper wall of the right frontal sinus. Epidermoid carcinoma of the left antrum with extension into the left ethmoids, nasal cavity, right antrum, and hard palate.

was found in 23 cases, i.e., in 35 per cent. In this group, as location of the primary tumor, the maxillary antrum was denoted in 21 cases, the ethmoids in one case, and the hard palate in one. However, the latter case and several others presented very widespread involvement of the maxillary ethmoid, and sphenoid sinuses, and the

Fig. 4. The white line of the right frontal sinus is demineralized in the lateral section; the outline is still sharp and smooth. In the medial section the white line has disappeared, the outline is still relatively sharp, with incipient, indistinct condensation in the surrounding area. Epidermoid carcinoma of the right ethmoid sinus, with extension into both antra, left ethmoid, sphenoid, and with destruction of the lesser wing, anterior clinoid, sella wall, region of the right optic foramen.

Fig. 5. Blurred, partly indistinct outline of the upper wall of the left frontal sinus. The septal contour is intact. The sinus is cloudy. Epidermoid papillary carcinoma of the left nasal cavity, with tumor mass in the left antrum and left ethmoid. Destruction of the walls of the left antrum, nasal cavity, and orbit.

nasal cavity on one or both sides. It was, therefore, in similar cases not feasible to differentiate the primary site. One of the invaded locations, usually the maxillary antrum, was denoted as primary in such cases only for working facility.

Biopsy of these 23 cases showed the primary tumor to be an epidermoid carcinoma in 21 cases, cylindrical cell carcin in one case, and transitional cell carcinoma in one.

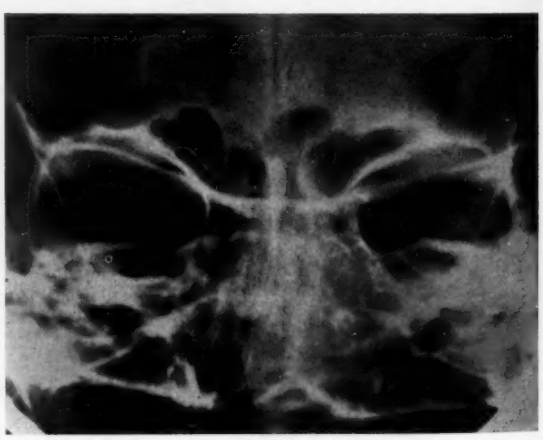

Fig. 6. The white line of the left frontal sinus is largely intact, but obscured by the intense shadow of the neighboring condensation. Squamous cell carcinoma of the left antrum, ethmoids, extending into the nasal cavity, sphenoid sinus, and nasopharynx.

ROENTGENOLOGIC APPEARANCE

The earliest roentgenologic change is the partial demineralization or disappearance of the white line, representing the normal compact layer of the wall of the frontal sinus; however, the outline remains sharp and smooth, making the alteration obvious only to the specially trained observer (Fig. 3 and 4). Later smaller or larger sections of the contour, sometimes the entire margin, attain a blurred appearance (Fig. 5). Occasionally the white line remains intact in some sections, but it will be obscured by condensation of the surrounding bony structure (Fig. 6). In advanced stages the blurring of the outline is more marked, more irregular, and a more or less extensive condensation of varying intensity is visible in the surrounding bony structure (Fig. 7, 8, and 9). Frequently various grades of the demineralization and condensation can be found simultaneously in different sections of the sinus wall (Fig. 6, 7, and 8). These changes are localized usually to the superior and posterior wall (Fig. 10). The anterior and inferior walls are rarely involved. Generally the alteration is unilateral on the tumor side. However, one can find it bilaterally also, and rarely on the contralateral side.

Fig. 8. The contour of the left side is visible, but without limiting white line. Marked surrounding condensation. The right margin is blurred, irregular, with very marked condensation of the surrounding bony structure. Septum is missing. Epidermoid carcinoma of the right antrum. Extension into the right orbit, both ethmoids, nasal cavity.

Roentgenologically the alteration resembles a low grade secondary osteitis which can be found occasionally in cases of longstanding infectious sinusitis with intermittent or constant occlusion of the sinus ostia by polypous or other alterations of the sinus membrane.

Fig. 7. Bilateral alterations. The white line is in great part intact, in short sections decalcified, the middle section indistinct, blurred. Marked surrounding condensation of varying intensity. Epidermoid carcinoma of the right antrum, with invasion into the nasal cavity, left antrum, ethmoids, sphenoid sinuses, with destruction of the great wing of the sphenoid. Cervical lymph nodes.

Fig. 9. The white line of the right side is demineralized, with marked condensation in the neighborhood. The left upper margin is very irregular, blurred, with very marked condensation. The upper half of the septum is also thickened and condensed. Epidermoid carcinoma of the right antrum, destruction of the inferior orbit wall and zygoma.

Fig. 10. The same case as in Figure 9. The lateral view shows that the alterations are localized to the superior and posterior wall of the frontal sinus.

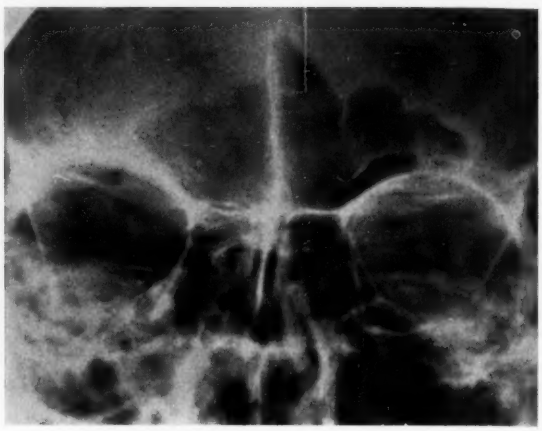

Fig. 12. Demineralization of the compact layer of the right frontal sinus, laterally condensation. Initial condensation at the left sinus margin. Chronic sinusitis for many years. One year ago Caldwell-Luc operation for polypoid degeneration in the right antrum. Recurrent polyposis. Polyp also in the left antrum.

OSTEITIS IN SINUSITIS CASES

In the current sinusitis material of this department similar alteration occurred in the last year only 3 times; one can estimate this frequency below 1 per cent when we know that several sinus films have been seen daily. However, this material consists of a mixture of routine examinations, acute and chronic cases of varying stages. For a more definite comparison I reviewed 800 consecutive sinus films of the Illinois Eye and Ear Infirmary of the University of Illinois. In 464 cases the roentgen finding was negative, or minor, insufficient for production of longer standing obstruction of the sinus ostia. In none of these cases was an alteration of the wall of the frontal sinus found. The remaining 336 cases were chronic, advanced, and were examined usually for surgical indication. Among this group alteration of the sinus wall was found 18 times, i.e., 5.3 per cent. This is a striking difference in frequency against the 35 per cent occurrence in carcinoma.

Fig. 11. Condensation stripe at the upper margin of the right frontal sinus, without demineralization of the white line. Chronic sinusitis of all sinuses of the right side, most intensive in the antrum, for two years.

DIFFERENTIAL DIAGNOSIS

The roentgenologic appearance of the alteration differs usually in finer details in inflammatory, and cancer cases respectively. The most conspicuous difference was the moderateness and uniformity of the changes in sinusitis cases. Demineralization or condensation of the white line, or condensation of the neighboring area was evenly distributed on the entire course of the wall. One could usually find only one type of alteration in the same case, not mixed as in cancer cases. Seemingly the development and progression of the alteration also differs somewhat. The alteration used to start with thickening of the white line which is only obscured by the condensation, but not lost, in contrast with the initial decalcifying changes of the cancer

cases. At times one cannot see any other change except a narrow condensation stripe at the upper margin without demineralization (Fig. 11). Later the simple demineralization of the compact layer occurs also, just as the blurring of the sinus margin (Fig. 12). However, the condensation, usually in moderate and uniform degree, remains the common dominant feature (Fig. 13). The usual type of the tumor cases, the irregular extensive blurring and condensation simultaneously, occurred in only 2 of the cases of chronic sinusitis (Fig. 14a and b); however, both cases were complicated with secondary osteomyelitis.

Osteomyelitic destruction can produce similar blurring of the bony wall of the frontal sinus (Fig. 15), but the margins are more irregularly ragged, and the condensation is usually missing. In a case of mucocele the same alteration was found, due to the secondary postoperative osteomyelitis.

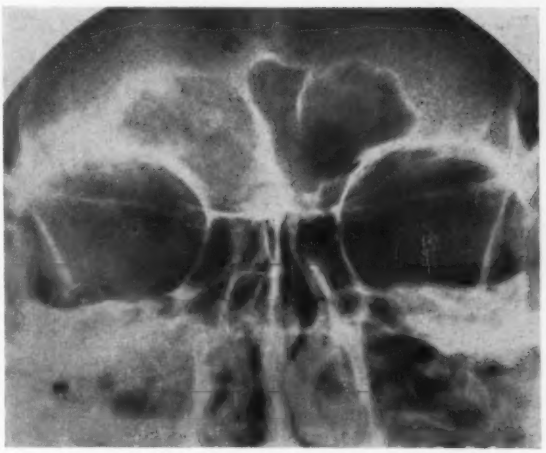

Fig. 13. Broader condensation stripe at the upper border of the right sinus passing over the septum to right. The margin is slightly blurred. The right sinus is cloudy. Chronic bilateral sinusitis and otitis media for many years. Right-sided mastoid operation. Caldwell-Luc operation for polypous degenerations of the right antrum.

THE PATHOLOGIC NATURE OF THESE SECONDARY ALTERATIONS IN CANCER CASES

The roentgenologic appearance resembles the changes of osteitis in chronic inflammatory sinus diseases, in spite of the described fine roentgenologic differences. The clinical course makes this assumption probable also, inasmuch as the alteration does not change significantly during longer observation, while in the same time the primary cancer and its other invasions progress rapidly and in great extension. However, theoretically a neoplastic explanation is possible also. Theoretically a secondary tumorous osteoplastic involve-

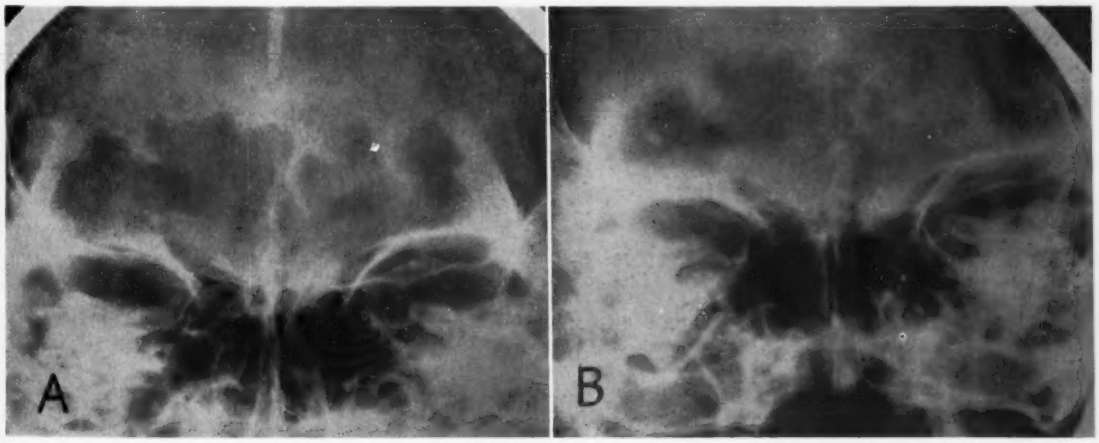

Fig. 14. (*A*) The white line has disappeared at the left side, demineralized at the right side. Irregular condensation of moderate intensity of the left border and of the sinus septum. Chronic bilateral sinusitis for many years. Exacerbation of the right frontal sinusitis with osteomyelitis and orbital abscess formation. Killian's operation. (*B*) Eight months after Killian's operation; blurred outlines. Condensation is extending, but is not very intensive.

Fig. 15. Blurred, partly irregularly ragged sinus margins. Mucous adenocarcinoma of the left antrum, healed seven years before by surgical, roentgen and radium treatments, with bony defects of the orbit, antral and nasal wall. Purulent osteomyelitis of the frontal sinus wall and empyema of the right antrum. Biopsy and surgery were negative for tumor.

ment of the bony walls of the frontal sinus could be realized, without involvement of the sinus cavity, along the mucous membranes, via the lymphatics or vessels, along the bone diploe, or by combination of these. There are well known alterations such as slow growing osteoplastic bony metastases, e.g., those of the prostatic carcinoma.

The tumor possibility could be excluded more definitely by biopsy or autopsy. The biopsy with adequate removal of the superior and posterior wall of the frontal sinus is not a neutral procedure on patients, usually in poor physical condition, and it may not be performed for curiosity without real clinical indication. Therefore, it had been accomplished adequately only in one of our cases with moderate roentgenologic alteration. In this case the biopsy showed only benign condensing osteitis without malignant change.

Special postmortem studies could not be performed to settle the question. The limited number of beds in our institution does not permit lengthy hospitalization of incurable patients. The patients die in other hospitals or in their homes without our knowledge.

DISCUSSION

The described secondary alteration of the frontal sinus wall was found in 35 per cent of cases of paranasal cancers. Similar changes occurred in only 5.3 per cent of the advanced chronic obstructive inflammatory sinus diseases. Therefore, the alteration has a diagnostic importance; it is rather pathognomonic diagnostically for the presence of a primary paranasal cancer. Its presence must be regarded as a premonitory sign, calling for special examination of the other sinuses to diagnose or to exclude cancer. In this sense, the accidental observation of this alteration on skull films led us in some of our cases to the actual finding of paranasal cancer.

Roentgenologically the alteration conforms to a benign secondary osteitis of the sinus wall, due to occlusion by the tumor. For definite exclusion of the possibility of a secondary neoplastic invasion of the sinus wall, special postmortem examination of similar sinuses would be necessary in hospitals where these patients die.

If it should be established, as it is assumed, that this alteration of the frontal sinus in cancer cases is caused always by benign secondary osteitis, the difference in frequency and in roentgenologic appearance could be explained by the difference in constancy, course, duration, and degree of the obstruction of the nasal passageways between cancer cases, and chronic inflammatory cases, respectively.

When the described alteration of the frontal sinus wall is found accidentally, exact clinical and roentgenologic examination is recommended for diagnosis or exclusion of paranasal cancer. Roentgenographic observation of the frontal sinus is advocated in all cases of paranasal carcinomas and in doubtful cases.

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ARTEFACTS SIMULATING MINIMAL PULMONARY TUBERCULOSIS*

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A TYPE of opaque, white artefact which occurs on the chest roentgenogram is often mistaken for a pulmonary infiltration. Although it may at times resemble an area of primary atypical pneumonia, or a fresh unorganized pulmonary infarct, this artefact is most likely to be confused with the early minimal lesion of pulmonary tuberculosis. For want of a more satisfactory and inclusive term, the shadows simulating such lesions have been referred to as "pressure mark" artefacts. In the general discussion of artefacts by Henny[4] and the brief review of the subject by Rabin,[5] the close resemblance of the above type of artefact to disease processes is not emphasized. Furthermore, the literature does not appear to contain an adequate account of the possible mechanisms by which such changes occur.

Artefacts are artificially produced marks appearing on the roentgenogram strictly as the result of technical variations or errors in the manufacture, handling or processing of the film. A long list enumerating these possible errors may be found in some of the bulletins on darkroom technique issued by film manufacturers[2] and roentgen-ray supply companies.[1]

The so-called "pressure mark" with which this paper is concerned differs from other artefacts in that it is dependent upon a local change in the sensitivity of the film emulsion with consequent alteration in its response to roentgen-ray exposure. These changes in sensitivity of the film are brought about by mechanical stretching, bending or compression. The opaque, white "pressure mark" results from the latter influences only when applied to the film before its roentgenographic exposure. The local alteration in sensitivity of film emulsion represents a "solarization" or reversal in the response of its silver salts to roentgen-ray exposure.

The effects of mechanical sensitization on areas of film are best understood by referring to the graph in Figure 1. This shows a curve representing the characteristics of roentgen film when exposed to any form of radiant energy.[3] The section A-B of this curve represents the normal

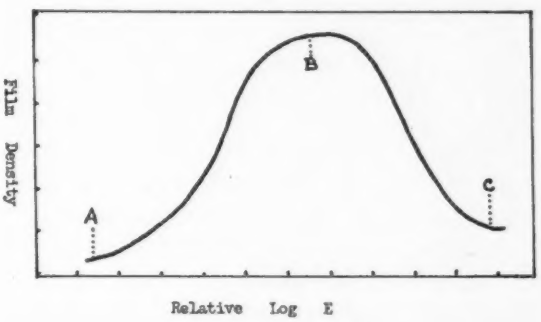

FIG. 1

exposure range, in which increased amounts of roentgen rays produce a progressively greater darkening of the film. The rate of such response to roentgen rays becomes less as the shoulder of the curve is reached at B. Local increases in sensitivity of the film appear to act like an increase in roentgen-ray exposure beyond ordinary limits, in that a reversal occurs in the film reaction, and the involved areas show less darkening than is normally expected. The film is then said to be reacting in the region of solarization (B-C).

The white "pressure mark" artefact has been noted to occur more frequently in films whose general sensitivity appears increased. In other words, such films as appear unusually blackened after having been subjected to normal roentgen-ray

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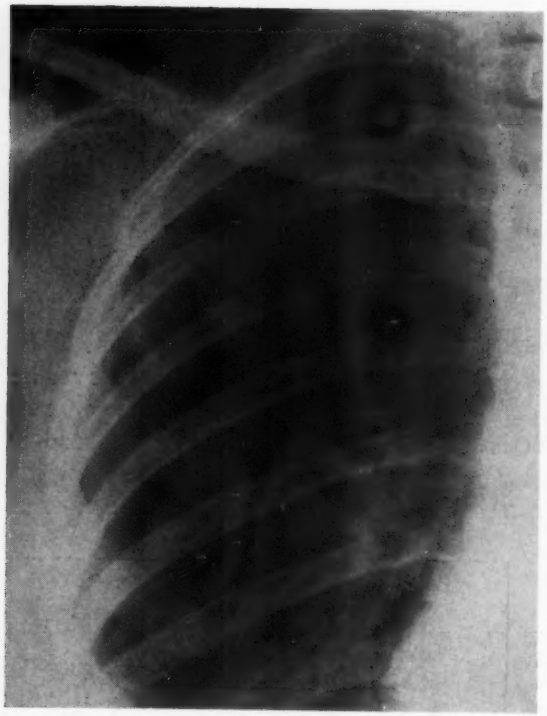

FIG. 2

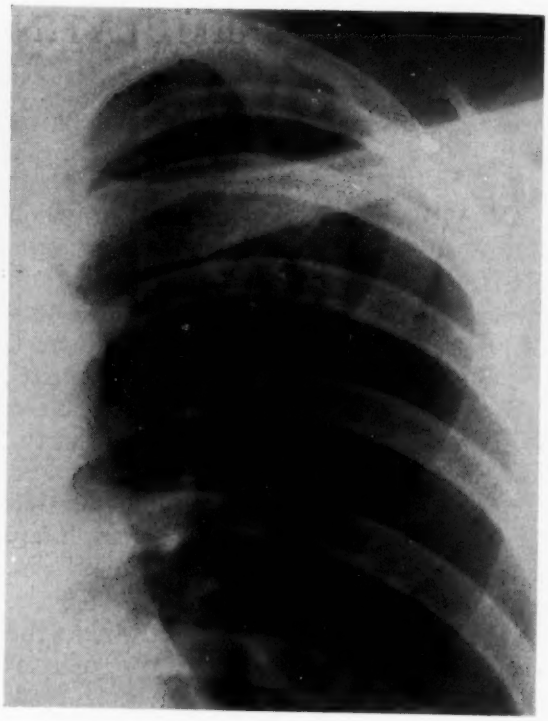

FIG. 3

FIG. 4

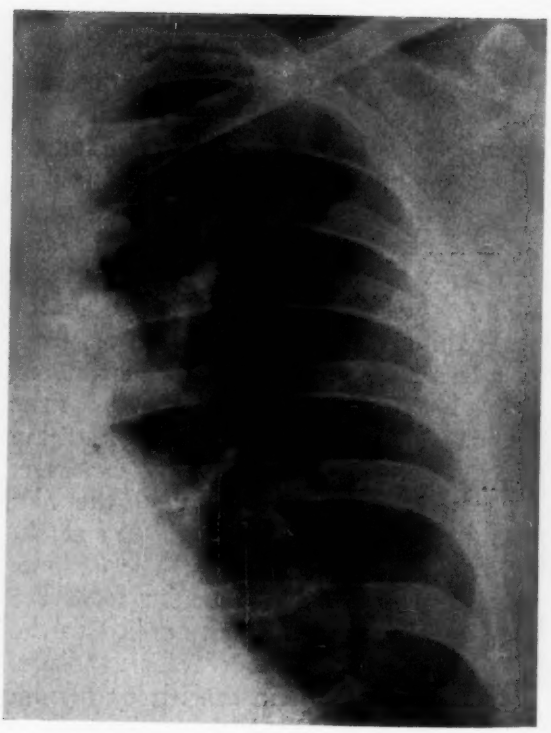

FIG. 5

exposure and development more frequently show these white "pressure marks." This is in accordance with the concept implied by the above film sensitivity curve. Another explanation for these artefacts has been suggested,[6] namely that the mechanical influences on the film emulsion results in a local decrease in its sensitivity and responsiveness and that the white mark therefore represents a failure to react rather than an over-reaction.

The typical "pressure mark" artefact is readily detected. It is seen in Figure 2 as a crescent shaped shadow overlying the second anterior intercostal space near the periphery of the right lung. At times it may be accompanied by a linear shadow extending out from its concavity. A less characteristic instance of this type of mark is noted in Figure 3, where the artefact overlies the first anterior intercostal space in the mid-lung region on the left side. Even less suggestive of the same phenomenon is the shadow seen in Figure 4 overlying the second rib and intercostal space anteriorly in the outer half of the left lung field. These three artefacts, representing variations of the same mechanism, are produced by a buckling or kinking of the film. A mechanical stretching of the film emulsion results along the line of its bending and alters the film's local sensitivity and subsequent response to roentgen rays. The shadows seen in Figures 3 and 4 differ from that in Figure 2 only in that they show varied degrees of "running" of the kink.

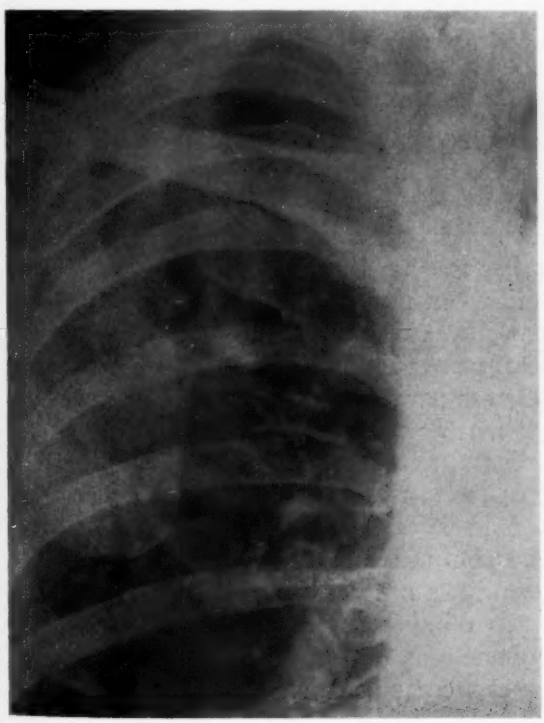

Fig. 6

Fig. 7

Another type of "pressure mark" is illustrated in Figure 5, where a linear shadow is seen to extend upward and outward over the medial aspect of the left lung at the level of the aortic arch. A somewhat shorter, flame-shaped variant of the same artefact is shown in Figure 6, overlying the first anterior intercostal space in the right mid-lung region. In Figure 7, an additional example of this kind of shadow

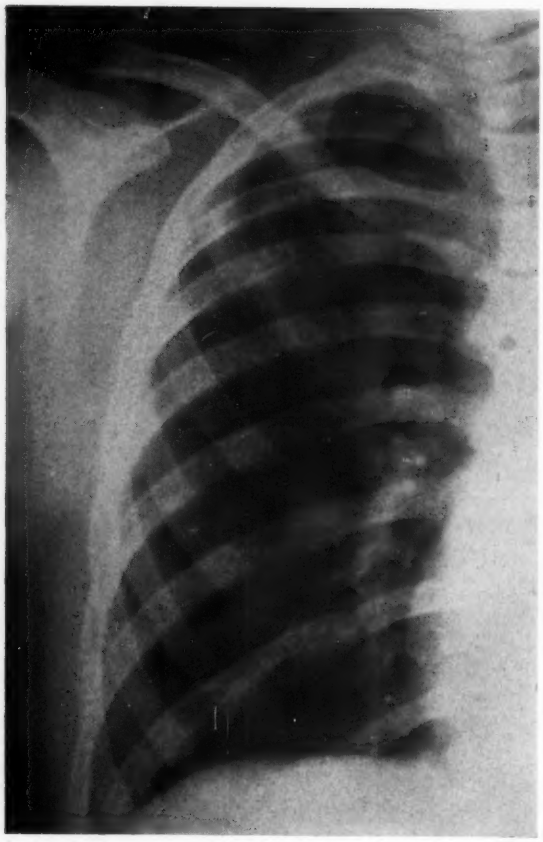

Fig. 8

may be noted overlying the second anterior intercostal space of the right lung. This one, because of its varying density, is more misleading than those in Figures 5 and 6. However, the presence of an accompanying artefact, extending out beyond the lateral chest wall and below the scapula, directs suspicion toward the nature of the shadow over the lung. These last three cases demonstrate a form of "pressure mark" in which the exact mechanism for the local alteration in film sensitivity is rather obscure. When seeking to locate and correct the source of their origin one must recognize the fact that such artefacts may be produced during the manufacturing and packaging of the film, and are therefore not always subject to the control of the physician or of his technician. In some instances, a whole batch of film may be found to show similar marks when developed.

The most striking example of the possibility for this "pressure mark" artefact to simulate a minimal tuberculous infiltrate is illustrated in Figure 8. Here a soft, poorly defined, irregular shadow is seen in the right infraclavicular region, overlying the first intercostal space anteriorly. Located in a common site for early tuberculous lesions, and being of a non-homogeneous nature, such an artefact might readily be interpreted as a significant infection. It is this type of shadow which may also be responsible for some of the so-called fleeting infiltrates, which disappear sooner than would be expected of tuberculous lesions, and which may erroneously be ascribed to "patches of atypical pneumonia." The only certain means of identification of this kind of artefact is by constant awareness of its possibilities and by immediate roentgenographic re-examination when it is suspected. This re-examination should be dependent upon a good chest roentgenogram rather than upon roentgenoscopy, since the latter might give false support to a suspicion of artefact by missing an early, faintly outlined tuberculous lesion.

COMMENT

Appearance alone is an unreliable guide in the differentiation of these shadows from true pulmonary infiltrations. Although "pressure marks" may be strongly suspected when the shadow in question shows a higher degree of whiteness than any other portion of the chest roentgenogram, and when this whiteness diminishes imperceptibly towards its periphery, an acute exudative tuberculous lesion of a confluent lobular nature has at times been noted to present a very similar appearance.

Except for the typical instance noted in Figure 2, the type of artefact described should always be confirmed as such, by re-examination. Unless verified, its presence may not only lead to the false diagnosis of an early minimal, asymptomatic tuberculous infiltration, but may, in some cases, complicate medical and surgical considerations in the treatment of existing tuberculous lesions. When the nature of

such a shadow is unsuspected, its occurrence can also delay discharge from the sanatorium of an otherwise apparently controlled case of pulmonary tuberculosis.

The observer's index of suspicion should be heightened with regard to the occurrence of atypical "pressure mark" artefacts when any of the following conditions are noted:

1. The presence of associated artefacts more readily identified by characteristic appearance (Fig. 2), or by location outside of the lung regions.

2. The presence of a generalized increase in film sensitivity as evidenced by a roentgenogram which appears darker than it should after normal exposure and development, or appears of uneven density. The shadow which appears crescent-shaped will be easily recognized as a typical "pressure mark," especially if accompanied by a sharp black "crinkle" line, or by a linear white mark bisecting its concavity. The observer's suspicions are confirmed when immediate roentgenographic re-examination fails to disclose the shadow previously noted.

SUMMARY

Attention is called to a type of artefact which may occur on roentgenograms of the chest. It is an opaque, white shadow which may readily simulate a minimal tuberculous infiltrate. Examples of such artefacts are shown and their differentiation from pulmonary lesions discussed.

Grateful acknowledgement is made to T. H. Hubbard, Technical Representative of the Photo Products Department of DuPont de Nemours & Co., for his helpful suggestions with regard to the above subject.

1127 Park Ave.
New York 28, N.Y.

REFERENCES

1. Dark Room Manual, Picker X-Ray Corp., New York, N.Y.
2. Dark Room Technique, DuPont Photo Products Department, Wilmington, Del.
3. DuPont X-Ray Notes, 1943, 1, 7.
4. Henny, G. C. Artefacts in roentgen films. *Radiology*, 1935, *24*, 350–356.
5. Rabin, C. B. In: Diagnostic Roentgenology. R. Golden, Editor. Thomas Nelson & Sons, New York, 1947, p. 196 MM.
6. Struck, G. R., Eastman Kodak, Co., Rochester, N. Y. Personal communication.

VIDEOGNOSIS*

ROENTGENOLOGIC TELEVISION DIAGNOSIS

A Service for the Small Community Hospital

By J. GERSHON-COHEN, M.D.

PHILADELPHIA, PENNSYLVANIA

THE Government-sponsored rapid expansion of hospital facilities for small communities necessitates provision, among other services, for competent radiologic supervision. Not only must more well trained technicians be provided, but experienced radiologists must devise some method for furnishing their services. Radiologic consultation might be provided by the full time attendance of young radiologic diplomates or by the part time service of older, more experienced radiologists located in the nearest larger centers. The latter arrangement is deficient in emergency situations and usually not entirely satisfactory on an economic basis. To remedy these defects, the use of a practical roentgenologic television service may now be entertained.

FIG. 1. Small television camera and monitor.

A highly effective television system has recently been devised in the RCA laboratories by Dr. P. K. Weimer under Dr. V. K. Zworykin which produces excellent black and white pictures at normal light levels. This system is based on a remarkably small and sensitive pickup tube known as the vidicon. There are only two units in the system, namely, a television camera approximating the size of a personal 16 mm. movie camera and a master control monitor weighing approximately 60 pounds that can be carried as easily as a suitcase (Fig. 1). The vidicon tube is approximately 1 inch in diameter and 6 inches in length. It is about one-tenth the size of the image orthicon tube and while it can transmit pictures at normal lighting levels, it can also attain a resolution of more than 400 lines. The construction of the vidicon is simple, containing only one electron gun and a target as contrasted with a gun, two-sided target, image section and electron multipliers in the image orthicon tube. The related equipment is also proportionately less complex. Most important, the cost of this transmitting equipment is about one-third of the regular full size professional apparatus and this cost, now approximately $4,000, is well within the budget range of small hospitals. Whereas the camera chain was designed for industrial application, its use for hospital roentgenologic consultation purposes is practically ideal. There is but one additional obstacle to be overcome, and that concerns the cost of transmission. In Philadelphia, where the first tests of this kind have been made, the telephone company has provided the means of transmission from the Jewish Hospital to our central city offices, a distance of approximately

* The term videognosis is used to simplify the many old terms necessary to describe the use of television for roentgen diagnostic purposes.

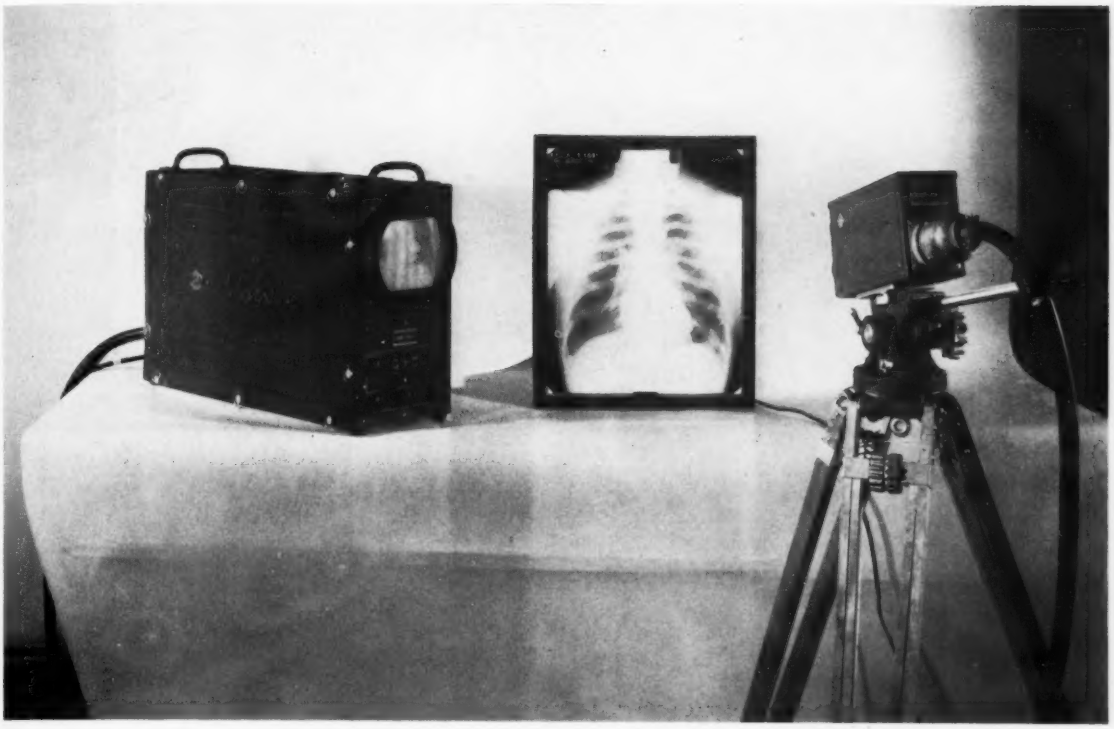

Fig. 2. A simple broadcasting set-up for roentgenologic television.

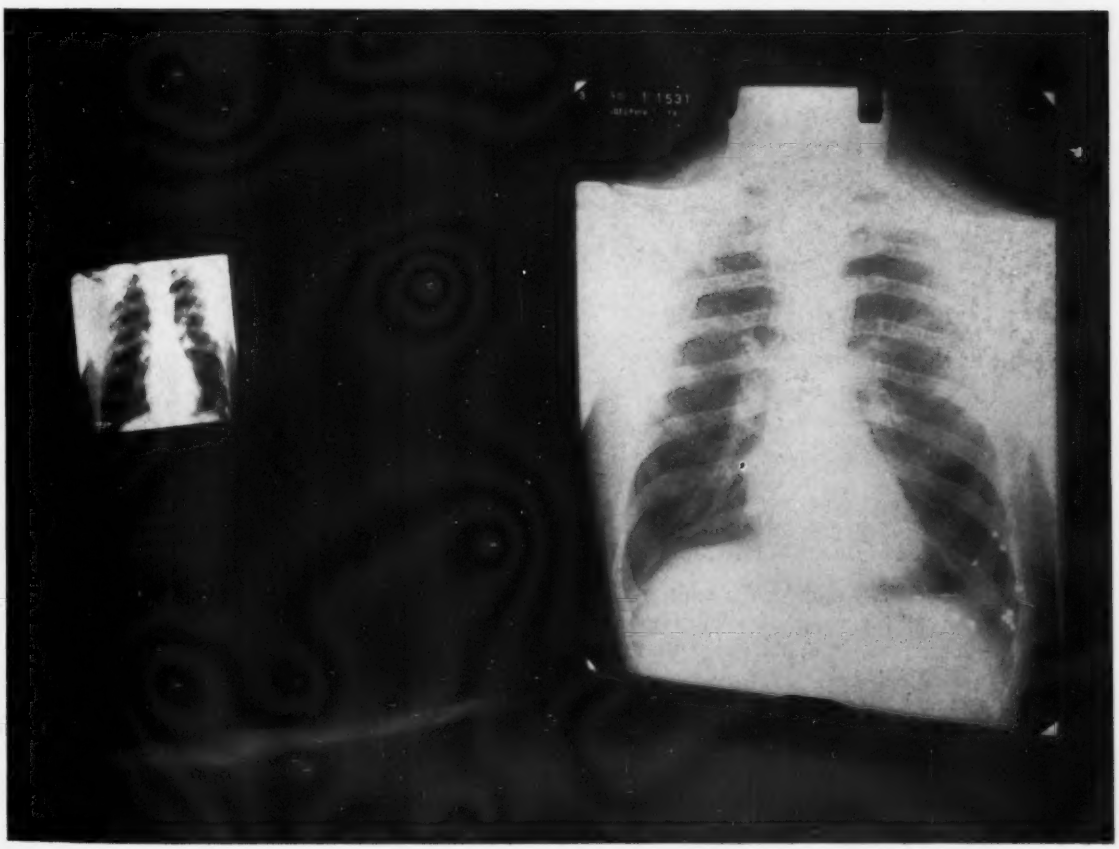

Fig. 3. The monitor chest image is on the left, and the roentgenogram is on the right.

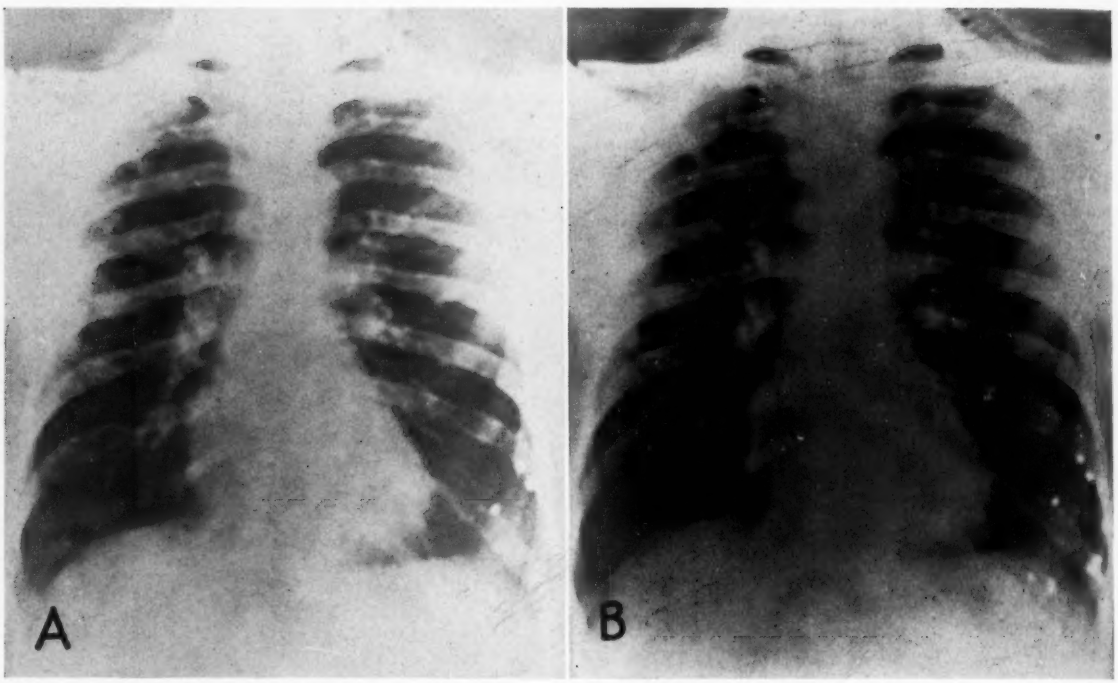

FIG. 4. (*A*) and (*B*) Photographs of a televised chest image to demonstrate extremes of contrast. Good photographs of television images are difficult to obtain, and they thus do not accurately reproduce these images.

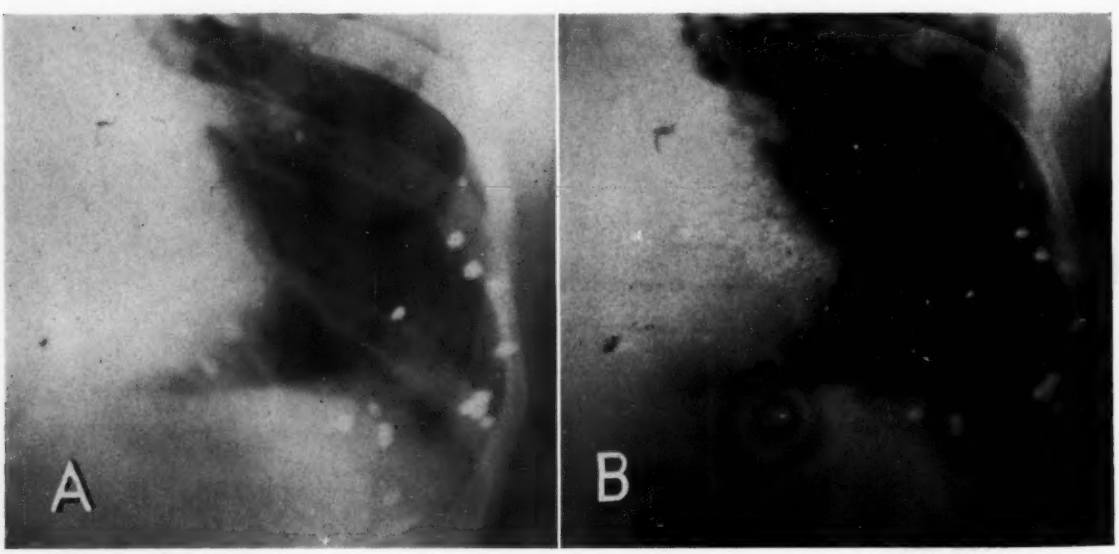

FIG. 5. (*A*) and (*B*) Photographs of a televised lung segment to demonstrate magnification and extremes of contrast. Many of the metallic bodies may be better seen in (*B*) than in (*A*). The rapid control of density variations made possible by television often proves helpful in the interpretation of the televised image.

6.5 miles. Microwave transmission at about 3 megacycles is used. Coaxial cable is employed from the transmission point to the microwave relay transmitter. The signals are beamed from a metal dish on the hospital roof to a similar dish atop the thirty story medical building housing our offices, and a coaxial cable connects this receiver

to our television set in the viewing room.

The charges for this service are high. A monthly service charge is made of $175 plus $20 for each quarter mile. Since the distance is 6.5 miles, a charge of $520 is added to the regular charge of $175, making a total of $695 per month. This fee cannot be sustained within the income of a small radiologic department, and it is hoped that just as the cost of television equipment for this purpose has been altered markedly downward with technical improvement, so with wider usage, transmission services shall be obtainable at costs within the scope of small hospital budgets. This is one reason that roentgen-ray facsimile now is more economical, since facsimile transmission can be obtained at about 20 per cent of television transmission costs.

The practical use of this television roentgen-ray service has been adequately demonstrated to those of us who have been experimenting with it. The quality of the television image is excellent, and with the controls, both on the transmitter and receiver, we can (1) vary the contrast shadings; (2) modify the size of the image; and (3) obtain excellent definition. While viewing the image, we can maintain direct telephone connections with the physician in charge, and this results in a service that meets all the requirements. For these reasons, I predict wide possibilities for this method in solving the problem of adequate roentgenologic service for the small community hospital.

SUMMARY

A television method of servicing the roentgen diagnostic needs of small community hospitals has been described. Except for the present rate of transmission costs, the expenditure needed to install and operate such a service is well within the means of a small hospital. The diagnostic adequacy of this method has been tested in a microwave set-up between the Jewish Hospital in Philadelphia and a central city office at a distance of 6.5 miles. Preliminary tests of the adequacy of such a set-up already had been made in the RCA and in our own laboratories.

My gratitude is extended to Messrs. P. B. Reed, M. C. Banca and E. C. Buurma of the RCA laboratories in Camden, New Jersey, for their help in making these tests possible.

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Fifty-third Annual Meeting, 1952: To be announced.

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Thirty-fourth Annual Meeting: Stevens Hotel, Chicago, Ill., June 8, 9 and 10, 1952.

EDITORIAL

THE FIFTY-SECOND ANNUAL MEETING OF THE AMERICAN ROENTGEN RAY SOCIETY

THE American Roentgen Ray Society held its Fifty-second Annual Meeting in Washington, D. C., at the Shoreham Hotel on September 25, 26, 27 and 28, 1951. The Society's return to Washington following a lapse of twenty-six years was thoroughly justified in all respects. Not only was the meeting the largest in its attendance but the character and quality of the scientific program which President-Elect H. Dabney Kerr and his committee had arranged proved to be as interesting and instructive as the preliminary program published in the August issue of the JOURNAL implied it would be. Perhaps rarely, if ever, have the scientific sessions of the Society's meetings been better attended than they were at the Washington meeting. From the opening of the meeting with the Address of Welcome to the Society given by Dr. William M. Ballinger, President of the Medical Society, District of Columbia, on Tuesday morning till the last scientific paper presented Friday afternoon the large meeting hall was crowded. The quality of the scientific program, the splendid attendance at all of the scientific sessions and the great number of registrants, there being over 1,600, thoroughly justified the selection of Washington as the meeting place for the Fifty-second Annual Meeting. Coupled with this, the splendid appointments of the Shoreham Hotel and its elegant surroundings added enormously to the pleasure of the meeting. Not only was there adequate space for the scientific sessions but perhaps there are few places, if any, better equipped to handle the commercial exhibits which are always a great feature of the Society's meetings; and the scientific exhibit hall was filled with excellent scientific exhibits. Many of the scientific exhibits supplemented and amplified papers which were given in the scientific sessions. This is always a splendid practice and Dr. C. Allen Good and his Scientific Exhibit Committee are to be congratulated both upon the extent and the educational scope of the exhibits. A detailed description of the scientific exhibits with the awards given appears elsewhere in this issue of the JOURNAL.

The Instruction Courses, which for the last several years have been so ably arranged by Dr. Harry M. Weber, again attracted capacity audiences and considerable enthusiasm; and there were many complimentary remarks concerning the faculty which had been chosen and the subjects which were presented.

As might have been expected, the Caldwell Lecture given on Tuesday evening by Dr. Wilder Penfield, Professor and Director of the Department of Neurology and Neurosurgery, McGill University, and Director of Montreal Neurological Institute, Montreal, Canada, on the subject of "Cranial Clues to Abnormalities of Brain and Dura" was brilliant and instructive.

It was a fortuitous circumstance that the National Bureau of Standards was celebrating its fiftieth anniversary, and on Wednesday evening, through the kindness of Dr. Lauriston S. Taylor, Chief of the Radiation Physics Laboratory, the Bureau had arranged to hold open house for those attending the meeting. This was a memorable evening in the Washington meeting and in appreciation of this invitation several hundred persons took advantage of

the opportunity to visit this great institution.

The commercial exhibitors availed themselves of the ample space which was allotted to them, and their exhibits were outstanding in every respect and evoked a marked degree of interest and favorable comment and large attendance. The commercial exhibits from year to year are an exhibition and demonstration of the finer things that have been accomplished by the manufacturers during the year, and certainly the commercial exhibits at the Washington meeting were superb. Among these, were a number of exhibits of publishing houses and these of necessity attracted a marked degree of interest, for from these books as well as the current medical literature radiologists keep abreast of the advances in medicine and other scientific endeavors.

Needless to say, in a city so charming and hospitable as Washington the social aspects of the meeting were in no way neglected and it can well be said that the social events were superbly planned.

The annual Golf Tournament, which was held on Monday at the Congressional Country Club, with the annual golf dinner in the evening, was splendidly attended by the enthusiastic golfers of the Society and their guests. Perhaps no banquet at an annual meeting was better planned or attended than the one in Washington held on Thursday evening.

To the Committee on Local Arrangements which was headed by Dr. Ralph M. Caulk the Society wishes through this medium to express its thanks for an excellent program of entertainment which had been arranged during the meeting and to the Ladies Committee which, under the chairmanship of Mrs. Aubrey O. Hampton, had arranged a number of interesting events for the visiting ladies.

We would be greatly remiss in any discussion of this year's meeting in Washington if we did not call particular attention to the superb manner in which the Shoreham Hotel housed the meeting and made available to the members of the Society and its guests all the facilities of the hotel, and to the staff and personnel of the Shoreham Hotel the Society is particularly grateful. The Society's thanks are also due the Convention Bureau of Washington which so ably cared for the registration and other details connected with the meeting. All in all, the Washington meeting represents a high point in the Society's annual gatherings.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting, 1952: To be announced.

American Radium Society
Secretary, Dr. J. E. Wirth, 635 Herkimer St., Pasadena 1, Calif. Annual meeting: Stevens Hotel, Chicago, Ill., June 8, 9 and 10, 1952.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 713 E. Genesee St., Syracuse 2, N. Y., Annual meeting: Palmer House, Chicago, Ill., Drive, Chicago 6, Illinois.

American College of Radiology
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6, Illinois.

Section on Radiology, American Medical Association
Secretary, Dr. T. Leucutia, Harper Hospital, Detroit 1, Mich.

Alabama Radiological Society
Secretary, Dr. W. W. Anderson, Tuscaloosa, Ala. Meets time and place Alabama State Medical Association.

Arizona Radiological Society
Secretary, Dr. R. Lee Foster, 507 Professional Building, Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

Arkansas Radiological Society
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

Atlanta Radiological Society
Secretary, Dr. J. D. King, 35 Linden Ave., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

Brooklyn Roentgen Ray Society
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, Oct. through April.

Buffalo Radiological Society
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

Central New York Roentgen Ray Society
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

Central Ohio Radiological Society
Secretary, Dr. F. A. Riebel, 15 West Goodale St., Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Columbus Athletic Club, Columbus, Ohio.

Chicago Roentgen Society
Secretary, Dr. B. D. Braun, 6 N. Michigan Ave., Chicago 2, Ill. Meets second Thursday of each month, October to April inclusive at the University Club.

Cleveland Radiological Society
Secretary, Dr. Mortimer Lubert, 10515 Carnegie Ave., Cleveland 6, Ohio. Meetings at 6:45 P.M. on fourth Monday of each month from October to April.

Colorado Radiological Society
Secretary, Dr. W. P. Stampfli, 1933 Pearl St., Denver, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

Connecticut Valley Radiologic Society
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday Oct. and April.

Dallas-Fort Worth Roentgen Study Club
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. J. C. Cook, Harper Hospital, Detroit, Mich. Meets monthly first Thursday, October to May, at Wayne County Medical Society Building.

East Bay Roentgen Society
Secretary, Dr. Dan Tucker, 434-30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

Florida Radiological Society
Secretary, Dr. Nelson T. Pearson, 1109 Huntington Bldg., Miami, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

Georgia Radiological Society
Secretary, Dr. R. C. Pendergrass, Americus, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

Greater Miami Radiological Society
Secretary, Dr. T. M. Berman, 350 Lincoln Rd., Miami Beach, Florida. Meets last Wednesday of each month at 8:00 P.M. at Veterans Administration Regional Office.

Houston Radiological Society
Secretary, Dr. F. M. Windrow, 1205 Hermann Professional Bldg., Houston, Texas. Meets fourth Monday each month.

Illinois Radiological Society
Secretary, Dr. Wm. DeHollander, St. John's Hospital, Springfield, Ill. Meets three times a year.

Indiana Roentgen Society
Secretary, Dr. William M. Lochr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

Iowa X-Ray Club
Secretary, Dr. Arthur W. Erskine, 326 Higley Bldg., Cedar Rapids, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society.

Kansas Radiological Society
Secretary, Dr. Anthony F. Rossitto, Wichita Hospital, Wichita, Kan. Meets annually with State Medical Society.

Kentucky Radiological Society
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Seelbach Hotel, Louisville.

Kings County Radiological Society
Secretary, Dr. Marcus Wiener, 1430 48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

Los Angeles Radiological Society
Secretary, Dr. Wybren Hiemstra, 1414 S. Hope St., Los Angeles 15, Calif. Meets second Wednesday each month at Los Angeles County Medical Assn. Building.

Louisiana Radiological Society
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

Maine Radiological Society
Secretary, Dr. C. F. Miller, Central Maine General Hospital, Lewiston, Maine.

Miami Valley Radiological Society
Secretary, Dr. G. A. Nicoll, 134 Apple St., Dayton, Ohio. Meets second Friday of fall and winter months.

* Secretaries of societies are requested to send timely information promptly to the Editor.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS
Secretary, Dr. R. D. McDuff, 220 Genesee Bank Bldg., Flint 3, Mich.

MID-HUDSON RADIOLOGICAL SOCIETY
Secretary, Dr. J. W. Walton, Horton Memorial Hospital, Middletown, N. Y. Meets 8:30 P.M., fourth Tuesday each month, Sept. to May.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

MINNESOTA RADIOLOGICAL SOCIETY
Secretary, Dr. L. A. Nash, 572 Lowry Medical Arts Bldg., St. Paul 2, Minn. Meets three times annually, once at time of State Med. Assn., and in spring and fall.

MISSISSIPPI RADIOLOGICAL SOCIETY
Secretary, Dr. John W. Evans, 621 High Street, Jackson 2, Miss. Meets third Thursday of each month at the Rotisserie Restaurant at 6:30 P.M.

NEBRASKA RADIOLOGICAL SOCIETY
Secretary, Dr. R. W. Blanchard, 1216 Medical Arts Bldg., Omaha, Nebr. Meets fourth Thursday of each month at 6 P.M. at Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. L. L. Robbins, Massachusetts General Hospital, Boston, Mass. Meets monthly on third Friday, Harvard Club.

NEW HAMPSHIRE ROENTGEN RAY SOCIETY
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. Irving Schwartz, 45 E. 66th St., New York 21, N. Y. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

NORTH CAROLINA RADIOLOGICAL SOCIETY
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

NORTH DAKOTA RADIOLOGICAL SOCIETY
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings by announcement.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY
Secretary, Dr. John F. Roach, Albany Hospital, Albany, N. Y. Meets on the second Wednesday of October, November and March at the University Club, Albany. Annual meeting in June to be announced.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB
Secretary, Dr. G. A. Fricker, Sacramento County Hospital, Sacramento, Calif. Meets at dinner last Monday, every second month, except June, July and August.

OHIO STATE RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio.

OKLAHOMA STATE RADIOLOGICAL SOCIETY
Secretary, Dr. W. E. Brown, 21st & Xanthus, Tulsa 4, Okla. Three regular meetings annually.

OREGON RADIOLOGICAL SOCIETY
Secretary, Dr. J. Richard Raines, 214 Medical-Dental Bldg., Portland 5, Oregon. Meets monthly from October to June on the second Wednesday of each month at 8:00 P.M. at the University Club.

ORLEANS PARISH RADIOLOGICAL SOCIETY
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

PACIFIC ROENTGEN SOCIETY
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport. Annual meeting: Bedford Springs Hotel, Bedford, Pa., May 16 and 17, 1952.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. G. P. Keefer, American Oncologic Hospital, Philadelphia 4, Pa. Meets first Thursday each month October to May, at 8:00 P.M., in Thomson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY
Secretary Dr. E. J. Euphrat, 3500 Fifth Ave., Pittsburgh 13, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

RADIOLOGICAL SECTION, BALTIMORE MEDICAL SOCIETY
Secretary, Dr. Richard B. Hanchett, 705–6 Medical Arts Bldg., Baltimore, Md. Meets third Tuesday each month, Sept. to May.

RADIOLOGICAL SECTION, CONNECTICUT MEDICAL SOCIETY
Secretary, Dr. Fred. Zaff, 135 Whitney Ave., New Haven, Conn. Meets bimonthly on second Wednesday.

RADIOLOGICAL SECTION, MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA
Secretary, Dr. U. V. Wilcox, 915 Nineteenth St., N. W., Washington 6, D. C. Meets Medical Society Library, third Thursday of January, March, May and October at 8:00 P.M.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. Roy G. Giles, Temple, Texas.

RADIOLOGICAL SOCIETY OF GREATER CINCINNATI
Secretary, Dr. L. J. Gibboney, 831 Carew Tower, Cincinnati 2, Ohio. Meets first Monday each month, at 7:30 P.M., September to May, inclusive.

RADIOLOGICAL SOCIETY OF KANSAS CITY
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

RADIOLOGICAL SOCIETY OF NEW JERSEY
Secretary, Dr. Nicholas G. Demy, 912 Prospect Avenue, Plainfield, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. George Gamsu, 191 S. Goodman St., Rochester, N. Y. Meets monthly on last Monday from September through May, 8 P.M. at Strong Memorial Hospital.

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr.

ST. LOUIS SOCIETY OF RADIOLOGISTS
Secretary, Dr. D. S. Bottom, 510 S. Kingshighway, St. Louis, Mo. Meets fourth Wednesday each month, except June, July, August, and September.

SAN DIEGO ROENTGEN SOCIETY
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Tuesday at dinner.

SAN FRANCISCO RADIOLOGICAL SOCIETY
Secretary, Dr. I. J. Miller, 2680 Ocean Avenue, San Francisco 27, Calif. Meets quarterly.

SECTION ON RADIOLOGY, CALIFORNIA MEDICAL ASSOCIATION
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

SECTION ON RADIOLOGY, ILLINOIS STATE MEDICAL SOCIETY
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

SHREVEPORT RADIOLOGICAL CLUB
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

SOUTH BAY RADIOLOGICAL SOCIETY
Secretary, Dr. Charles E. Duisenberg, 300 Homer Avenue, Palo Alto, Calif. Meets second Tuesday each month.

SOUTH CAROLINA X-RAY SOCIETY
Secretary, Dr. Henry E. Plenge, Spartanburg General Hospital, Spartanburg, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

TENNESSEE RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Frère, Newell Hospital, Chattanooga,

Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Meets Houston, Texas, Jan. 18 and 19, 1952.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

Utah State Radiological Society
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

Virginia Radiological Society
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

Washington State Radiological Society
Secretary, Dr. R. C. Kiltz, 705 Medical-Dental Bldg., Everett, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.

Wisconsin Radiological Society
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-Ray Study Club of San Francisco
Secretary, Dr. M. A. Sisson, 450 Sutter St., San Francisco, 8, Calif. Meets Jan. to July, Lane Hall Stanford Univ. Hospital; July to Dec. San Francisco Hospital.

Cuba, Mexico and Central America

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

Sociedad Mexicana de Radiologia y Fisioterapia
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

Sociedad Radiológica Panameña
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86 Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 P.M.
Medical Members' meeting, on third Friday in each month at 5:00 P.M., 32 Welbeck St., London, W 1.

Faculty of Radiologists
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets third Friday each month at 4:45 P.M. at the Royal Society of Medicine, 1 Wimpole St., London.

Canadian Association of Radiologists
Honorary Secretary-Treasurer, Dr. Jean Bouchard, Suite 305, 1555 Summerhill Avenue, Montreal 26, Que. Meetings January and June.

Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

Société Canadienne-Française d'Electrologie et de Radiologie Médicales
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

Australian and New Zealand Association of Radiologists
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.

Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. L. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. de G. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179 B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

South America

Asociacion Argentina de Radiologia
Secretary, Dr. Lidio G. Mocsa, Avda. Gral Paz 151, Córdoba, Argentina. Meetings held monthly.

Sociedad Argentina de Radiologia, Junta Central, Buenos Aires
Secretary, Dr. Oscar F. Noguera, Santa Fe 1171, Buenos Aires. Meetings are held monthly.

Sociedad Argentina de Radiologia, Filial del Litoral, Sede, Rosario
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 19 ha 663 Italia St., Rosario, Santa Fe.

Sociedad Argentina de Radiologia, Filial del Sur, Sede, La Plata
President, Prof. Dr. Jose P. Uslenghi, La Plata. Meets monthly.

Sociedad Argentina de Radiologia, Filial del Centro, Sede, Cordoba
President, Prof. Dr. David L. Caro, Corro 86, Cordoba. Meets monthly.

Sociedad Argentina de Radiologia, Filial del Norte, Sede, Tucuman
President, Dr. Julio Mendez Valladares, Rivadavia 358, Tucuman. Meets monthly.

Sociedad Argentina de Radiologia, Filial de Cuyo Sede, Mendoza.
President, Dr. J. A. Orfila, Hospital Central, Mendoza. Meets monthly.

Sociedade Brasileira de Radiologia Medica
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

Sociedade Brasileira de Radioterapia
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9 P.M. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

Sociedad Colombiana de Radiologia
Secretary, Dr. Alberto Torres Focke, Av. 34, No. 17–34, Bogota, Colombia. Meets last Wednesday of each month.

Sociedad Peruana de Radiologia
Secretary, Dr. Julio Bedoya Paredes, Apartado, 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini, Av. Agraciada 1464, Piso 13, Montevideo, Uruguay.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Allies, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

Société Française d'Electro-Radiologie Médicale, and its branches: Société du Sud-Ouest, du Littoral Méditerranéen, du Centre et du Lyonnais, de l'Ouest, de l'Est, et d'Alger et d'Afrique du Nord

Secretary-General, Dr. A. Dariaux, 9 bis, Boulevard Rochechouart, Paris IX°, France.

CESKOSLOVENSKÁ SPOLEČNOST PRO RÖNTGENOLOGII A RADIOLOGII V PRAZE
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

GDANSK SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10:30, X-Ray Dept., Akademia Gdansk.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

SOCIETATEA ROMANA DE RADIOLOGIE SI ELECTROLOGIE
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD.
USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

SOCIEDAD ESPANOLA DE RADIOLOGIA Y ELECTROLOGIA
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

SCHWEIZERISCHE RÖNTGEN-GESELLSCHAFT (SOCIÉTÉ SUISSE DE RADIOLOGIE)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

SOCIETA ITALIANA DI RADIOLOGIA MEDICA
Secretary Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

INDIA

INDIAN RADIOLOGICAL ASSOCIATION
Secretary, Dr. R. F. Sethna, Navsari Building, Hornby Road, Bombay 1, India

SCIENTIFIC EXHIBIT

The Scientific Exhibit at the Fifty-second Annual meeting of the American Roentgen Ray Society held at the Shoreham Hotel, Washington, D. C., September 25, 26, 27 and 28, 1951, which was arranged by the Scientific Exhibit Committee under the chairmanship of Dr. C. Allen Good, was among the best and largest that the Society has displayed. Under the stimulus of Dr. Good there appeared to be a continuance of interest in the scientific exhibits of the annual meeting as shown not only in the number but in the quality of the exhibits. Needless to say, an intense interest among the members and guests was shown in the scientific exhibits as evidenced by the fact that during all of the periods which were allotted for viewing the scientific exhibits the hall in which they were held was crowded to the doors, and the exhibitors gave most generously of their time in explaining in detail the features of their exhibits.

Some idea of the scope and the extent of the exhibits may be had from the following descriptions of each scientific exhibit together with the awards which were made to the various exhibitors.

Separate Neural Arch. Maurice B. Roche, M.D., and George G. Rowe, M.D., Washington University School of Medicine, St. Louis, Missouri. The incidence of the separate neural arch in a series of 4,200 adult skeletons was presented in a table and chart according to race (white and Negro), sex and age; from these, 32 lumbosacral columns showing different types and levels of the separation were selected for demonstration. Summaries of roentgenographic findings in the lumbosacral region of 100 white males between one and sixteen years of age and of examination of fetuses (including reports in the literature) were shown by graph and table. Photographs of successive stages of a dissection of the lumbosacral region presenting a separate neural arch in the fifth lumbar vertebra were included, as well as the wet, ligamentous preparations.

Mechanism of Skull Fracture; Types and Mechanism of Production. E. S. Gurdjian, M.D., J. E. Webster, M.D., and H. R. Lissner, Professor in Engineering, Wayne University College of Medicine and Grace Hospital, Detroit, Michigan. This exhibit consisted of photographs, roentgenograms of skulls with explanatory legends, graphs, demonstration of location of fractures on plastic squares, latex skulls.

Roentgenology of the Breast. J. Gershon-Cohen, M.D., and Helen Ingleby, M.D., Jewish Hospital, Philadelphia, Pennsylvania. This was a combined exhibit of roentgenograms and mounted whole breast sections correlating the roentgenology and pathology of mammary disease, with emphasis on the differential diagnosis of breast tumors.

Gross Osteopathology in Ancient Races. William J. Tobin, M.D., T. D. Stewart, M.D., and D. J. O'Regan, Lt. j.g. (M.C.), Georgetown University School of Medicine and Department of Physical Anthropology, Smithsonian Institution, Washington, D. C. This exhibit consisted of a large number of specimens showing pathological changes. The material was from the huge collection of skeletal remains in the Department of Anthropology of the United States National Museum, Smithsonian Institution, Washington, D. C. Examples of congenital defects, infectious processes, trauma, the arthritides, tumors, etc., were included. The adult phases of such conditions as coxa vara, osteochondritis of the femoral head and slipped femoral epiphyses were among the interesting specimens. Bones with lesions suggestive of syphilis and tuberculosis in the early American Indian were shown. Roentgenograms of all specimens were included in the exhibit, with descriptions and interpretative diagnoses. A paper was given in the scientific program on the same subject.

Original Roentgen Anatomical Studies of the Orbits. Lewis E. Etter, M.D., Western Psychiatric Institute and Clinic, University of Pittsburgh, Pittsburgh, Pennsylvania. This material represented an analysis of the component bones of the orbits and roentgenographic lines contributed by each one. These were identified by lead markers and cut sections to prove sites of origin. Several new features have been revealed by this method, e.g., a frontal bone component of the oblique orbital line, exact boundaries of the inferior orbital fissures and identification of a pseudo-foramen adjacent to the optic foramen in some skulls.

Roentgen Visualization of the Intervertebral Disc. Robert E. Wise, M.D., C. Robert Hughes, M.D., W. James Gardner, M.D., and Edw. C.

Weiford, M.D., Cleveland Clinic Foundation, Cleveland, Ohio. This exhibit consisted of a demonstration of technique and results of injection of the nucleus pulposus with diodrast.

Histogenesis of Myositis Ossificans. Lent C. Johnson, M.D., Armed Forces Institute of Pathology, Registry of Orthopedic Pathology, Washington, D. C. A group of 54 illustrations demonstrating the manner of development of myositis ossificans from twenty-four hours after the injury to many years later was presented. The transient calcification of necrotic muscle that precedes the true myositis ossificans, the constant resemblance to sarcoma in the first thirty days, the multiplicity of histological patterns at the sixth week stage, and the variable end results were illustrated. The manner of secondary attachment to bone and eventual appearance as to osteochondroma, of bizarre patterns in the paravertebral muscles, and the secondary effects on underlying bone were pointed out. This exhibit was awarded a Certificate of Merit.

Survey Examination of the Colon with Barium and Tannic Acid. George M. Wyatt, M.D., Orangeburg Regional Hospital, Orangeburg, South Carolina. This exhibit consisted of examples of post-evacuation films of the colon. In each instance the patient had taken licorice powder and given himself a warm water enema before reporting. On reporting he was handed an enema mixture which he administered himself and then expelled. The only roentgen-ray procedure involved was the taking and developing of a 14 by 17 inch film. The exhibitor is convinced of the merit of the double contrast method and uses tannic acid only in survey work and selected cages.

The above project was conceived and started at Johns Hopkins Hospital and completed in South Carolina.

It is believed that this survey method excludes about 90 per cent of all tumors of the colon larger than 1 cm. in diameter.

Malignant Primary Tumors of Bone. Gwilym S. Lodwick, M.D., William L. Thompson, Col., M.C., U.S.A., and Lent C. Johnson, M.D., Armed Forces Institute of Pathology, Registry of Orthopedic Pathology and Registry of Radiologic Pathology, Washington, D. C. The Registry of Orthopedic Pathology and the Registry of Radiologic Pathology presented an exhibit of ten types of bone neoplasms, clearly identifying the distinguishing features of each, using suitable photographs of gross anatomic, histopathologic and roentgenographic materials. Both typical and atypical forms were illustrated, the latter underlining the roentgenographic resemblances of one type to another. All of these tumors are malignant or potentially so. Each type was displayed separately, requiring 12 sections with an extra section for miscellaneous rare tumors.

The individual section consisted of a "typical" case prototype with gross and histopathologic photographs accompanied by roentgenograms of 7 other cases with varying degrees of atypicality. The tumors demonstrated were: (1) osteogenic sarcoma, (2) osteolytic sarcoma, (3) giant cell tumor of bone, (4) chondrosarcoma, (5) chondroblastoma, (6) parosteal osteoma, (7) reticulum cell sarcoma of bone, (8) fibrosarcoma of bone, (9) multiple myeloma, (10) Ewing's sarcoma. The purpose of this exhibit was to show the common roentgen-ray patterns of each type of tumor and simultaneously the range of variations from the usual pattern. A paper was given in the scientific program on the same subject. This exhibit was awarded the Bronze Medal.

Microradiography. Wallace S. Tirman, M.D., Harry W. Banker, M.D., and Charles H. Caylor, B.S., Caylor-Nickel Clinic, Bluffton, Indiana. The exhibit included microradiographs demonstrating the normal vascular pattern of various rabbit organs. The procedure consists of the injection of a contrast substance into the arterial circulation of each organ. Roentgenograms are taken of thin sections (up to 400μ) on spectroscopic plates using a diffraction roentgen-ray unit. These roentgenograms can be studied microscopically and can be enlarged as much as 500 times. This exhibit was awarded a Certificate of Merit.

The Differential Diagnosis of Bronchogenic Carcinoma. Jesse B. Johnson, M.D., Joe C. Rude, M.D., and Caroline W. Rowe, M.D., University of Texas Medical Branch, Galveston, Texas. Many lesions of the chest in which the roentgenologist is called upon for aid in diagnosis assume a similar appearance. This exhibit demonstrated proved cases of bronchogenic carcinoma, rarer malignant tumors, benign tumors, inflammatory lesions and anomalies which must be differentiated. Many cases included photomicrographs of the specimen.

Periosteum in Roentgen Diagnosis; Periosteal Findings in Health and Disease. Jame G. Lorman, M.D., David C. Gastineau, M.D., Richard A. Silver, M.D., and John A. Camp-

bell, M.D., Indiana University Medical Center, Indianapolis, Indiana. The sensitive, highly vascular, osteogenic membrane surrounding the cortex of bone responds to the stimulation of adjacent inflammatory, neoplastic, traumatic, nutritional and degenerative diseases, as well as to some diseases of unknown origin.

The periosteal proliferation is always an important point in the roentgenological study of bone lesions and sometimes may suggest the specific diagnosis. A review of the various conditions affecting the periosteum was presented in exhibit form. The diagnostic significance of the different types of periosteal reaction was evaluated. To achieve, this an attempt was made to correlate the histopathology and the roentgen findings wherever possible and to determine whether the numerous periosteal changes are useful as specific or pathognomonic evidence. This exhibit was awarded a Certificate of Merit.

Examination of the Colon. Henry C. Crozier, M.D., John W. Crossan, M.D., Lowell S. Goin, M.D., and Harold P. Tompkins, M.D., Queen of Angels Hospital, Los Angeles, California. This exhibit was in two parts: Part I consisted of photographs, drawings and descriptive material explaining the preparation of the patient, the apparatus employed and the technique of double contrast studies of the colon. Part II included roentgenograms demonstrating the pathologic entities which may be discovered in routine double contrast examinations of the colon.

Diagnosis of Ureteropelvic Junction Obstruction. William C. MacCarty, Jr., M.D., and William L. McLaughlin, M.D., Hitchcock Clinic, Hanover, New Hampshire. This exhibit emphasized the advantages of taking delayed roentgenograms during an intravenous pyelogram in the anteroposterior, posteroanterior and upright positions. With these additional views an accurate diagnosis of ureteropelvic junction obstruction may be established without the unnecessary instrumentation of retrograde pyelography which itself carries with it a definite added risk to the patient. The exhibit included a brief description of the technique, history abstracts, roentgenograms and colored photographs of the corrective surgical procedures and specimens.

Roentgenologic Recognition of Habenular Calcification as Distinct from Calcification in the Pineal Gland; Its Application in Cerebral Localization. H. M. Stauffer, M.D., L. B. Snow, M.D., and A. B. Adams, M.D., Department of Radiology, Temple University Hospital and School of Medicine, Philadelphia, Pennsylvania. Calcification in the pineal region in a significant percentage of cases will be found to have characteristic semilunar component anteriorly. In encephalograms this calcification is found lying over the habenular commissure in the posterior wall of the third ventricle. Since this calcification may lie upwards of 10 mm. anterior to the posterior margin of the pineal gland, it should be considered when measurements are made from the pineal calcification in the lateral skull roentgenogram; this is of particular importance in measurements for stereo-encephalotomy. A paper was given in the scientific program on the same subject. This exhibit was awarded a Certificate of Merit.

A Biplane Stereoscopic Angiographic Unit: Simultaneous exposures with two Fairchild roll-film magazines, on a single injection of opacifying medium, with stereoscopic tube-displacement between successive half-second-interval exposures. W. Edward Chamberlain, M.D., Herbert M. Stauffer, M.D., and Archie W. Blackstone, Temple University Hospital, Philadelphia, Pennsylvania. Card-mounted transparencies and suitably mounted rolls of original film from the Fairchild rapid-sequence magazine were shown on the illuminators. Accessory equipment such as oscillographs, special stereoscopes, etc., were displayed on pedestals or tables adjacent to the illuminators. The purpose of the exhibit was to set forth certain important features of the biplane stereo-angiographic unit. Among these are the following: (1) the unique mechanical features of the device; (2) the contribution made by a standard, operating-room "all-purpose chair table" to the positioning of patients for cerebral angiography; (3) the use of direct-writing oscillographs and event-markers for placing on a single, accurately measured time axis, such events and phenomena as (a) the patient's electrocardiogram, (b) the duration of time of occurrence of each consecutive roentgen-ray exposure, (c) the time of occurrence and the rate of injection of the opacifying medium.

Roentgenographic Visualization of Intervertebral Discs. Jeffrey P. Moore, M.D., Victor A. Reyes, M.D., and Henry T. Wycis, M.D., Departments of Radiology and Neurosurgery, Temple University Hospital, Philadelphia, Pennsylvania. This exhibit demonstrated the results in 25 cases of disc visualiza-

tion by direct injection with contrast medium (diodrast) and comparison studies using the myelographic method. Results thus far do not warrant this procedure as routine but cases of disc rupture have been shown when myelographic methods have failed.

Ulcerative Granulomatous Ileojejunitis. Richard H. Marshak, M.D., B.S. Wolf, M.D., S. A. Brahms, M.D., J. J. Lipsay, M.D., S. Otani, M.D., and A. I. Friedman, M.D., The Mount Sinai Hospital, New York, New York. Fifty cases of ulcerative granulomatous ileojejunitis were presented with pertinent clinical and pathologic data and detailed roentgen descriptions. Four cases in this series had massive and 3 more had limited local resections of the small intestine. The cases have been classified into non-stenotic and stenotic forms to facilitate roentgen study. In the non-stenotic stage, abnormal mucous membrane pattern evidenced by cobble-stoning and ulcerations of varying degree, rigidity and separation of loops of bowels, are the earliest roentgen features encountered. When ulceration is diffuse, the appearance resembles that seen in ulcerative colitis. Segmentation is not a prominent feature and when found the diagnosis of ileojejunitis should be reconsidered.

The stenotic stage shows many of the roentgen features seen in terminal ileitis. These include the string sign, skip areas of dilated bowel, rigidity and separation of loops of small intestine. However, fistula formation is seen much less commonly and a reticulated mucous membrane pattern is more frequent.

Pathologic correlation with the roentgen findings was emphasized. A paper was given in the scientific program on the same subject.

Large Hyatid Cyst of the Liver. Charles W. Perkins, M.D., Norwalk, Connecticut. Case Report. Mrs. E. B. was referred for symptoms referable to the liver and gallbladder. The patient, aged sixty-nine, had lived in Austria, Hungary, on a farm near Rumania, and had dogs, cattle, sheep and raised vegetables.

She came to the United States at the age of nineteen, appeared well nourished, complained of indigestion after eating, associated with vomiting, but at no time had evidence of jaundice. She had borne six children; all of her pregnancies were uncomplicated. Her present symptoms have persisted for some years. All physical signs and symptoms pointed to gallbladder disease; otherwise, she has always been fairly well. Previous history does not elicit any special illness or operation.

Cholecystographic examination showed filling and emptying of the gallbladder in about the normal time. Above the gallbladder, pressing on it, was shown an enormous large calcified cystic mass as large as an ostrich egg in the liver region and posterior to it in the region of the dorsal and lumbar spine.

Studies of the gastrointestinal tract revealed no abnormality.

The patient would not submit to operation, but a diagnosis of a large hyatid cyst was made from the roentgenological studies. The patient at this time is in fairly good health. Roentgenograms illustrating this interesting case were shown.

Serial Angiographic Techniques. Charles T. Dotter, M.D., and Israel Steinberg, M.D., New York Hospital, Cornell University Medical College, New York, New York. A fluorescent display was used to demonstrate several of the more interesting applications of serial angiography. These included retrograde and direct peripheral arteriography, cerebral angiography, retrograde abdominal aortography and angiocardiography.

Photofluorography for the Detection of Unsuspected Gastric Neoplasms. Russell Wigh, M.D., and Paul C. Swenson, M.D., Jefferson Medical College Hospital, Philadelphia, Pennsylvania. This exhibit consisted of charts and various data concerning the examination of over 5,300 persons, both male and female, using the Schmidt optics in photofluorographic camera equipment. The criteria used for the selection of a person as a suitable candidate for the mass experiment were first, that he be over the age of forty, and second, that a physician indicate that in his opinion there were no complaints which would justify a regular fluoroscopic and roentgenographic examination of the upper gastrointestinal tract. The results of these examinations were analyzed and the costs and justification for the continuation of survey work of this type were amplified with charts, and in addition the photofluorograms were made available on a number of cases for viewing under a lens equipment built for that purpose. This exhibit amplified a paper on the same subject which was given in the scientific program. This exhibit was awarded a Certificate of Merit.

Localized Thinning and Enlargement of the Cranium with Special Reference to the Middle Fossa. Arthur E. Childe, M.D., Winnipeg, Canada. This exhibit consisted of thirty-five photographic prints illustrating the various findings in 13 patients in whom six different

types of intracranial abnormalities were encountered: (1) relapsing juvenile chronic subdural hematoma—1 case; (2) chronic subdural hygroma—7 cases; (3) cerebral agenesis—1 case; (4) cerebral glioma—2 cases; (5) carotid aneurysm—1 case; (6) neurofibromatosis—1 case. Although relatively rare, this type of cranial abnormality occurs sufficiently often to warrant more consideration than it has received in the past. The commonest site for the thinning and enlargement was the middle cranial fossa and its immediate vicinity. Most of the patients were children or young adults. A paper was given in the scientific exhibit on the same subject.

Irradiation of Advanced Cancer through a Grid. Hirsch Marks, M.D., Welfare Island Dispensary, Department of Hospitals, New York, New York. The use of a lead-rubber grid which allows up to 40 per cent transmission of the air dose enabled the author to administer very high doses of the order of magnitude of 20,000 to 30,000 r by fractionated therapy. The grid is placed over the area to be irradiated in a chess-board or sieve pattern, and, by these means, healing and resolution have been obtained in such difficult sites as the vulva and the bladder.

The method was illustrated by samples of the different size grids used, photographs of films placed in a phantom depicting the streamers of roentgen rays traversing the phantom, tables of depth dose charts, photographs, photomicrographs, and films of various patients displaying (1) inoperable carcinoma of lung, (2) carcinoma of lips and buccal mucosa, (3) mediastinal Hodgkin's disease with extension to left lung and left supraclavicular region, (4) ulcerated metastatic carcinoma of inguinal region, primary in the anus, (5) metastatic carcinoma in the supraclavicular regions, primary in the breast, (6) advanced intraoral carcinoma with regional metastases, (6) carcinoma of pyriform sinus with metastases to cervical lymph nodes, (8) extravesical extension of a carcinoma of the urinary bladder, after partial cystectomy, (9) carcinoma of vulva with metastases to inguinal region, (10) intrasellar neoplasm, (11) Stage IV carcinoma of cervix, and (12) inoperable carcinoma of antrum.

Delayed Effects of Million Volt Irradiation on Normal Tissues and Testicular Tumors. Aubrey O. Hampton, M.D., Irving B. Brick, M.D., H. I. Amory, Col., M.C., U.S.A., Milton Friedman, M.D., and Lloyd G. Lewis, M.D., Walter Reed General Hospital and Garfield Memorial Hospital, Washington, D. C. This exhibit consisted of charts and photographs illustrating the delayed effects of million volt irradiation. The exhibit amplified considerably the paper which was given in the scientific session on essentially the same subject. This exhibit was awarded the Silver Medal.

Co^{60} in Treatment of Head and Neck Cancer. Joseph L. Morton, M.D., and George W. Callendine, M.S., Department of Radiology, the Ohio State University, Columbus, Ohio. The physical properties and radiation spectrum of Co^{60} used alone or in conjunction with other methods offer technical advantages not easily secured by more conventional therapy. Useful techniques for regions about the head and neck were illustrated by cases and models.

Applicators for External Radium Therapy. R. E. Fricke, M.D., M. Van Herik, M.D., and M. M. D. Williams, M.D., Mayo Clinic, Rochester, Minnesota. This exhibit displayed external radium applicators which are versatile in their adaptability for treatment of lesions of various sizes and shapes. These applicators can be loaded, applied and disassembled easily and with minimum radiation hazard to both the operator and patient. The applicators are constructed primarily of lucite and consist of a detachable base section which contains no radium, and a radium-containing top section, which at the appropriate time may be attached to the base section on the patient. Displayed in the exhibit were the applicators, instruments used for handling the applicators, and photographs.

Clinical Application of Scintillation Counters. Michel Ter-Pogossian, M.S., Ph.D., William B. Ittner, III, M.S., and William B. Seaman, M.D., Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis, Missouri. This exhibit consisted of a demonstration of a scintillation counter and stand designed for the localization of brain tumors; demonstration of other types of scintillation counters used for dosimetry in the living patient, determination of isodose curves, and isotope excretion and uptake measurements. A paper was given in the scientific program on the same subject.

The Johns Hopkins Fluoroscopic Screen Intensifier. Russell H. Morgan, M.D., and Ralph E. Sturm, The Johns Hopkins Hospital, Baltimore Maryland. This instrument has been developed to brighten or intensify the fluoroscopic screen by a factor of 1,000 or more times. The

instrument has been developed through a combination of the engineering principles of television and the optical principles of photofluorography. It consists of a conventional fluoroscopic screen, Schmidt optical system and a closed television link which includes an image orthicon pick-up tube. The instrument also includes a kinescopic projector for large audience demonstrations and provisions for making of motion pictures. This exhibit was awarded the Gold Medal.

Roentgen-ray Penumbra and Depth Dose Distribution. Gerhart S. Schwarz, M.D., Presbyterian Hospital, New York, New York. *Problem:* In a previous publication it had been shown that an unexpectedly large pneumbra effect is produced by the top diaphragm of commercially available therapy cones in air. The question has been raised whether this effect is present in the depth of tissues or whether the well known marginal intensity drop due to lack of lateral scattering does obliterate this phenomenon. The following frames were presented in an attempt to answer this question.

Roentgenograms of the cross section of a roentgen-ray beam as it emerges from a 4 by 5, 80 cm. cone and as it passes through various layers of a masonite phantom were presented. Isodensity curves of these roentgenograms were also presented on transparencies. Similarly roentgenograms of the longitudinal section of a beam passing through the phantom were shown with the top diaphragm of the cone in place and after its removal. Corresponding isodensity curves were displayed, showing that they are more rectangular when the beam is limited by a lead diaphragm placed at the entrance of the beam into the phantom. They show a "flame shaped" arrangement, however, when the beam is limited by the top diaphragm of the cone. This is the result of the penumbra effect.

A time-density curve of the film used for these experiments, processed identically and exposed to the same radiation as the other exhibited films at the same intensity of radiation was presented. No true gamma exists at this range of photographic density, but the average gradient serves here as a good guide for translating density into roentgen dosage. As is shown, the density of the film and the dose of roentgen rays producing it are roughly proportional.

Conclusions: (1) The penumbra effect outweighs the marginal intensity drop caused by lack of contributing lateral scatter. (2) The effect is the more important the narrower the beam and the longer the target-skin distance. (3) A large focal spot in therapy tubes is less desirable than a small one. (4) "Lead tipped" cones and umbrella cones remedy this problem to some extent but are heavier than conventional cones. (5) Masking the patient's skin with lead portals will *not* remove or reduce the penumbra unless the top diaphragm of the cone is removed or enlarged.

Diagnosis of Brain Atrophy. Averill Stowell, M.D., Robert Hayne, M.D., and Dorothy Brown, R.N., Springer Clinic, Tulsa, Oklahoma. This exhibit consisted of transparent reproductions of encephalograms and ventriculograms demonstrating a technique for the roentgenologic diagnosis of cerebral and cortical atrophy. There were also some posters outlining the arguments in favor of the method and the results which had been obtained at the Springer Clinic.

COMMERCIAL EXHIBIT

In the Commercial Exhibit, which is one of the most valuable and interesting features of the annual meetings of the American Roentgen Ray Society, are incorporated the advances in technical apparatus which contribute so much to the progress of radiology. The Commercial Exhibit at this year's meeting of the Society, which was held at the Shoreham Hotel, Washington, D. C., September 25, 26, 27 and 28, 1951, was no exception to the rule both as to the quality and the character of the exhibits. The exhibit was an extensive one; thirty-six exhibitors had reserved a total of seventy-five booths and the newer designs in apparatus were exhibited to great advantage in the splendid exhibit area that was allotted to these displays. The various commercial exhibits were placed in sections in the hotel not only adjacent to the registration but to the meeting room and scientific exhibit hall. The arrangement was such as to permit of easy access to all of the commercial exhibits and following the policy inaugurated some few years ago a sufficient time was allotted in the arrangement of the program for a careful study of the exhibits. The Society extends not only its thanks but its

appreciation to all of the firms exhibiting their products; their presence added a great deal to the success of the meeting.

The following firms were represented in the Commercial Exhibit:

Amperex Electronic Corporation, Brooklyn, New York; *Ansco*, Binghamton, New York; *Automatic Seriograph Corporation*, College Park, Maryland; *Bar-Ray Products, Inc.*, Brooklyn, New York; *Coreco Research Corporation*, New York, New York; *E. I. du Pont de Nemours & Company*, Wilmington, Delaware; *Eastman Kodak Company*, Rochester, New York; *Eldorado Mining and Refining (1944) Limited*, Ottawa, Ontario; *Eureka X-Ray Tube Corporation*, Chicago, Illinois; *Fairchild Camera and Instrument Corporation*, Jamaica, New York; *Franklin X-Ray Corporation*, Philadelphia, Pennsylvania; *General Electric Company*, Schenectady, New York; *General Electric X-Ray Corporation*, Milwaukee, Wisconsin; *Grune & Stratton, Inc.*, New York, New York; *Paul B. Hoeber, Inc.*, New York, New York; *Kelley-Koett Manufacturing Company, Inc.*, Covington, Kentucky; *Lea & Febiger*, Philadelphia, Pennsylvania; *Liebel-Flarsheim Company*, Cincinnati, Ohio; *Macalaster Bicknell Company*, Cambridge, Massachusetts; *Machlett Laboratories, Inc.*, Springdale, Connecticut; *F. Mattern Manufacturing Company*, Chicago, Illinois; *Micro X-Ray Recorder, Inc.*, Chicago, Illinois; *Thomas Nelson & Sons*, New York, New York; *North American Philips Company, Inc.*, Mount Vernon, New York; *Pako Corporation*, Minneapolis, Minnesota; *Picker X-Ray Corporation*, New York, New York; *W. B. Saunders Company*, Philadelphia, Pennsylvania; *Schering Corporation*, Bloomfield, New Jersey; *Frank Scholz X-Ray Engineering Service, Inc.*, Boston, Massachusetts; *Standard X-Ray Company*, Chicago, Illinois; *Charles C Thomas, Publisher*, Springfield, Illinois; *Victoreen Instrument Company*, Cleveland, Ohio; *Webster Photocraft*, Fort Lauderdale, Florida; *Westinghouse Electric Corporation*, Pitts burgh, Pennsylvania; *Winthrop-Stearns, Inc.*, New York, New York; *Year Book Publishers, Inc.*, Chicago, Illinois.

NEW OFFICERS AMERICAN ROENTGEN RAY SOCIETY

At the Fifty-second Annual Meeting of the American Roentgen Ray Society held at the Shoreham Hotel, Washington, D. C., September 25–28, 1951, the following officers were elected for the year 1951–1952: *President-Elect:* Dr. Charles L. Martin, Dallas, Texas; *1st Vice-President:* Dr. Paul C. Swenson, Philadelphia, Pennsylvania; *2nd Vice-President:* Dr. T. Leucutia, Detroit, Michigan; *Secretary:* Dr. Barton R. Young, Philadelphia, Pennsylvania (re-elected); *Treasurer:* Dr. Wendell G. Scott, St. Louis, Missouri (re-elected); *Member of the Executive Council:* Dr. Paul C. Hodges, Chicago, Illinois. The *President* is Dr. H. Dabney Kerr, Iowa City, Iowa, and the *Chairman of the Executive Council* is Dr. Earl E. Barth, Chicago, Illinois.

QUESTIONNAIRE TO DETERMINE EFFECTS OF RADIATION ON GENETIC STRUCTURE OF MAN

To the Editor:

This is a request for the American Journal of Roentgenology and Radium Therapy to call the attention of all radiologists to the fact that within the next few weeks each radiologist in this country will receive a questionnaire concerning the frequency of congenital deformities among workers in the field of roentgen radiation. This National Survey, which is made possible by a Grant-in-Aid from the United States Public Health Service, will help determine the effects of ionizing radiation on the genetic structure of man. It should also indicate whether the present radiation tolerance limits and protective standards are satisfactory or whether they should be modified.

The questionnaire will be sent to approximately 4,000 radiologists and other workers in the field of radiation and a similar number of questionnaires will be sent to other physicians who do not come into contact

with roentgen rays. A biostatistician will analyze the results. A small pilot study has already indicated that further investigation of this problem should be carried out; *e.g.*, one radiologist has been found to have a congenitally deaf child; a second radiologist had a child diagnosed as congenitally deaf but who gave evidence of regained hearing later; a third radiologist had a child with congenital absence of one ear.

It is hoped that each radiologist will complete the questionnaire with great care and thereby contribute to the significance and value of this important study.

STANLEY H. MACHT, M.D.
Washington County Hospital
Hagerstown, Maryland

COLORADO RADIOLOGICAL SOCIETY

At a recent meeting of the Colorado Radiological Society, the following officers were elected for 1951–1952: *President*, Dr. Charles F. Ingersoll; *Vice-President*, Dr. W. C. Huyler; *Secretary*, Dr. W. P. Stampfli; *Treasurer*, Dr. Vernon L. Bolton.

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY

At the recent meeting of the Rocky Mountain Radiological Society held in Denver, Colorado, August 9, 10 and 11, 1951, the following officers were elected: *President*, Dr. Edward J. Meister, Denver, Colo.; *President-Elect*, Dr. H. Milton Berg, Bismarck, N. D.; *1st Vice-President*, Dr. James F. Kelly, Omaha, Nebr.; *2nd Vice-President*, Dr. Mark S. Donovan, Denver, Colo.; *Secretary-Treasurer*, Dr. Maurice D. Frazer, Lincoln, Nebr.; *Historian*, Dr. John Bouslog, Denver, Colo.; *Executive Committee*, Dr. Galen M. Tice, Kansas City, Kan.; Dr. D. Arnold Dowell, Omaha, Nebr.; Dr. Tom B. Bond, Fort Worth, Tex.

RADIOLOGICAL SECTION, MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA

On May 17, 1951, at the meeting of the Radiological Section, Medical Society of the District of Columbia, Washington, D. C., the following officers for the year 1951–1952 were elected: *President*, Dr. Isadore Latman; *Vice-President*, Dr. Alfred A. J. Denn; *Secretary-Treasurer*, Dr. U. V. Wilcox.

SOUTHEASTERN STATES CANCER SEMINAR

The fifth annual meeting of the Southeastern States Cancer Seminar will be held on November 28, 29 and 30, 1951, in the San Juan Hotel, Orlando, Florida. The faculty will include Dr. Vincent P. Collins, Dr. Alfred Gellhorn, Dr. Cushman D. Haagensen, Dr. Perry B. Hudson, Dr. Herbert B. Maier, Dr. Joseph J. McDonald, Dr. Milton R. Porter, Dr. Arthur P. Stout, and Dr. Gray H. Twombly, from the staff of the Francis R. Delafield Hospital, New York.

AMERICAN BOARD OF RADIOLOGY

The next examination by the American Board of Radiology will be held in the Spring of 1952. The deadline for filing applications for this examination is December 31, 1951. Applications should be sent to the Secretary of the Board, Dr. B. R. Kirklin, Mayo Clinic, Rochester, Minnesota.

Vol. 66, No. 5

ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. Leucutia, M.D., Harper Hospital, Detroit 1, Michigan

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ROENTGEN DIAGNOSIS

Head

Camp, John D. Significance of intracranial calcification in the roentgenologic diagnosis of intracranial neoplasms. *Radiology*, Nov., 1950, *55*, 659–668.

Ordinary roentgenography of the skull will reveal with considerable accuracy the site and frequently the type of an intracranial lesion. Calcification within a lesion is the most significant roentgenologic sign of intracranial disease. Fifteen per cent of all intracranial tumors show roentgenographic evidence of calcification. Position of the calcium shadow localizes the lesion, and frequently the arrangement of the calcium deposits will enable prediction of the probable histopathologic character. Displacement of a calcified pineal body may furnish evidence of the presence of a cerebral neoplasm without calcification.

Minimal routine for examination of the skull should include exposures in the lateral, postero-anterior and Towne projections. Lateral roentgenograms should be made stereoscopically, and special positions may be helpful.

Varying degrees of calcification of the pineal body may normally be observed in roentgenograms of 60 per cent of persons more than twenty years of age. Large amounts of calcification in the pineal region suggest a pinealoma. Teratomas of the pineal body, as in other areas, may exhibit combinations of bone and fat, the fatty portion generally yielding a peripheral shadow of diminished density.

Displacement of the pineal body from its normal position occurs in 39 per cent of all cases of tumor of the brain. A calcified pineal body displaced from its normal position thus indicates the presence of intracranial space-occupying lesion, and the direction and degree of shift is a valuable aid in localization of the lesion.

Gliomas make up 49 per cent of all brain tumors and 15 per cent exhibit calcification in the roentgenogram. Incidence of calcification is highest in oligodendrogliomas where the calcification occurs predominantly in irregular, subcortical strands, extending over a relatively large area. This configuration is almost typical of this tumor although it may be imitated by astrocytoma. Calcification seen in ependymomas is grossly identical with that seen in meningiomas, being a conglomerate collection of discrete punctate shadows. The occurrence in children or adolescents and subcortical location are aids in distinguishing it from meningiomas.

Craniopharyngiomas produce calcification more frequently than any other intracranial tumor with up to 70 per cent of these tumors producing roentgenographic evidence of calcification. These calcifications may be found above the clinoid processes, posterior to the posterior clinoid processes and even within the sella turcica. Shadows of calcification are usually faint, irregular and flocculent. Secondary changes in the skull resulting from pressure are frequent in craniopharyngiomas, with the posterior clinoids usually involved, eroded from above or destroyed completely. Calcification in dermoids and cholesteatoma may be mistaken for calcification in craniopharyngioma.

Eighteen per cent of meningiomas produce roentgen evidence of calcification. The conglomerate, punctate appearance is imitated by that occurring in ependymomas. Meningiomas occur on the surfaces of the brain especially in the parasagittal region. In about 50 per cent of the cases there is an associated osteoma in the adjacent bone. They are surface tumors and rarely affect persons under twenty years of age.

Greater use of cerebral angiography is resulting in discovery of more primary vascular lesions involving the blood vessels of the brain, both vascular malformations and true tumors of vascular origin.—*A. W. Sommer, M.D.*

Bernstein, Theodore C., Krueger, Erich G., and Nayer, H. R. Tuberculoma of the brain; surgical removal in the presence of widespread tuberculosis. *Am. Rev. Tuberc.*, Dec., 1950, *62*, 654–666.

Tuberculomas of the brain are rarely encountered, constituting from 1 to 3 per cent of all brain tumors. They are secondary to a focus elsewhere in the body, most commonly arising by hematogenous spread. The authors present 2 cases in which intracranial tuberculomas were resected despite the presence of widely disseminated lesions of tuberculosis. It is felt that if the lesions had not been removed both patients would have died. As it is, the patients are alive eight and thirteen months after operation. Although both patients seemed in good condition at the time of writing, prognosis in both remains guarded.

The authors conclude that the improved prognosis in tuberculosis, which stems from the use of the newer therapeutic agents, will probably be reflected in improvement of the results following removal of intracranial tuberculoma.—*Hugh Caumartin, M.D.*

Kaplan, Abraham. Ependymoma of lateral ventricle; report of a case of more than twelve years' survival. *Am. J. Dis. Child.*, Dec., 1950, *80*, 963–969.

The author states he is reporting this case because the patient is the youngest on record to have a complete removal of an ependymoma from the lateral ventricle, because so few and contradictory clinical findings were produced by so large a neoplasm, because of interesting ventricular studies and because of the patient's continued survival

period in excellent health in spite of malignant histopathologic findings.

The patient, a boy, was operated upon when five years of age. Roentgenograms of the skull after ventricular air injection showed a compressed left lateral ventricle with a smooth crescentric defect in the left occipital region displacing the occipital horn downward and also showed some air above the displacing mass.

No roentgen therapy was given. Since his discharge from the hospital, twelve years ago, the patient has hardly had a sick day.—*R. S. Bromer, M.D.*

Shapiro, Robert. Intraventricular glioblastoma multiforme with the pneumographic characteristics of intraventricular epidermoids; case report with critical analysis. *Radiology*, Dec., 1950, *55*, 852–854.

Recently, it has been implied in the literature that the pneumographic findings of a bizarre collection of air about the folds of an intraventricular mass is pathognomonic of an intraventricular epidermoid. The author believes that any intraventricular tumor of similar gross appearance will produce similar findings and cites a case where an intraventricular glioblastoma multiforme produced such a picture.—*M. B. Goodwin, M.D.*

Stobbe, G. Dorr, and Dargeon, Harold W. Embryonal rhabdomyosarcoma of the head and neck in children and adolescents. *Cancer*, Sept., 1950, *3*, 826–836.

This report represents a composite study of 15 cases seen at the Memorial Hospital, New York, in the past seventeen and one-half years.

Embryonal rhabdomyosarcomas in children usually arise from the cervical, facial or orbital musculature, and grow by expansion and infiltration. Lack of circumscription and encapsulation permits infiltrative growth to predominate. The firmness and color of the tumor depend upon the collagen content and vascularity, respectively.

Histopathological recognition is sometimes missed. A syncytium of spindle cells forms the basic cellular composition with round cells and, rarely, giant cells seen in association. Longitudinal fibrils may be present but cross striations are only occasionally demonstrated. Vascularity is sparse and the stroma is composed of collagen and argyrophile fibrils. In contrast, the mature rhabdomyosarcoma shows prominent cross striations and giant cells, with fewer round cells and less pronounced anaplasia of the spindle cells.

In the cases studied, the ages ranged from sixteen months to sixteen years, and the mean duration of the disease until inauguration of treatment was three and one-half months. The mean survival was one year and five months, with extremes ranging from four months to three years and nine months. Four of the 15 patients are still alive, having survived seven months, twelve months, twelve years and fourteen years, respectively.

The clinical feature is a tumor mass which may be hyperemic and painful. Symptoms due to pressure on neighboring structures may ensue, and cerebral involvement is ultimate. Symptoms of distant metastases depend upon the site, with lungs, pleura, mediastinal lymph nodes, ovaries, and vertebral column being most frequently involved. Spread of the tumor by infiltrative growth is common; distant metastases are principally blood borne, although dissemination through lymph channels is observed. Involvement of the regional lymph nodes is rare. A prominent feature of the embryonal rhabdomyosarcoma is recurrence of the tumor following treatment.

The treatment advised consists of wide excision with postoperative irradiation (by deep roentgen or radium therapy) in the event of recurrence. Regional lymph nodes may be excised providing there is no other metastasis. Frequent clinical observations are necessary due to the high propensity of the tumor to recur. The latter feature gives a poor prognosis.

Photomicrographs and a chart summarizing the 15 cases are included in this report.—*J. W. Wilson, M.D.*

Bruce, Karl W., and Stafne, Edward C. The effect of irradiation on the dental system as demonstrated by the roentgenogram. *J. Am. Dent. A.*, Dec., 1950, *41*, 684–689.

The authors report 5 cases in detail concerning the effect of irradiation on the dental tissues. These patients received treatment at the ages of from six months to $2\frac{3}{4}$ years. The dental examination was made six to ten years later and the following effects were noted: (1) injury to the tooth germ, to the extent that a tooth will not form; (2) dwarfing of permanent teeth; (3) premature calcification of permanent teeth; (4) early eruption of permanent teeth.—*C. P. Galanti, M.D.*

Mallett, Stephen P. Fractures of the jaw; survey of 2,124 cases. *J. Am. Dent. A.*, Dec., 1950, *41*, 657–673.

There are reported 1,124 cases of fracture of the jaw from Boston City Hospital, with the exact site of the fracture mentioned in 1,000 cases for analysis. Tables are given showing the distribution of regions involved and summary of individual fractures of the mandible.

Fractures of the mandible occur about twenty times as frequently as fractures of the maxilla and the most common sites in the mandible are between the angle of the jaw and the third molar region and

between the cuspid and the mental region. This is probably due to the structural weakness of the bone in these regions.

In all cases, before reduction, five extraoral roentgenograms were taken: one in the posteroanterior view, one in the right and one in the left lateral view of the body of the mandible, and one each in the right and left lateral views of the ascending ramus of the mandible to include the coronoid and the condyloid processes. In some cases, the extraoral roentgenograms were supplemented with intraoral films to determine the direction of the fracture, the possible complications at the site of the fracture, if any root or segmental fracture is present and to demonstrate a fracture that may not show in a lateral roentgenogram of the jaw.

Before reduction of fractures of the jaw and following reduction and fixation, good roentgenograms are of paramount importance.—*C. P. Galanti, M.D.*

Weder, Carman. Adamantinomas. *Canad. M. A. J.*, Dec., 1950, *63*, 590–594.

Weder reports the experience of the Saskatoon Cancer Clinic in dealing with adamantinomas. Only 8 cases were reported out of 11,743 malignant tumors. The site was equally divided between lower and upper jaw. The age incidence varied between twenty-eight and sixty-eight years. The principal clinical feature was a slow-growing, painless lump bulging the facial contour outward. None of the tumors showed metastases to regional lymph nodes.

The diagnosis depended upon (1) clinical history and physical diagnosis, (2) roentgenography and (3) biopsy. The roentgen appearence is one of a centrally expanding tumor which bulges the overlying periosteum outwards.

The only satisfactory treatment is radical excision. Incision and curettement is not curative. Irradiation may have a palliative effect upon some tumors but no cures are reported by roentgen therapy alone.—*J. H. Harris, M.D.*

Wawro, N. William, and Reed, John. Fibromyxoma of the mandible; report of two cases. *Ann. Surg.*, Dec., 1950, *132*, 1138–1143.

Fibromyxoma of the facial bones is a rare benign tumor, usually occurring in young adults. The lesion is most often mistaken for a benign dentigerous cyst and diagnosis therefore frequently depends upon examination of biopsy material. When small, the tumor may be well circumscribed but when allowed to grow it may infiltrate bone, producing considerable bone destruction and facial disfigurement. Limited local resection of the lesion in the latter instance will invite subsequent recurrence. Since the lesion does tend to invade bone and is histopathologically a well differentiated tumor, the authors feel that it is not likely to respond well to radiation therapy. They suggest that the treatment of choice is adequate surgical resection with microscopic control and prosthetic and plastic reconstruction as required in any individual case.

These points are illustrated in 2 case reports of large lesions, one in the mandible and the other in the maxilla, both treated by wide excisions and plastic repair of the surgical defects.—*J. A. Martin, M.D.*

Ingram, M. D., Jr., and Hamilton, W. M. Cephalohematoma in the newborn. *Radiology*, Oct., 1950, *55*, 503–507.

Cephalohematoma in the newborn is a tumefaction due to the effusion of blood between the periosteum of the skull and the calvarium itself. The authors report an incidence of 1.66 per cent, with the greatest number occurring in the parietal region.

The most important contributing etiological factors are increased infant weight and the use of forceps in delivery.

Encephalocele, subcutaneous hematoma with depressed fracture, and caput succedaneum must be considered in the differential diagnosis. The roentgenographic differences are presented.—*E. E. Seedorf, M.D.*

Vogler, E. Über Cataracta calcarea im Röntgenbild. (The roentgen picture of calcified cataract.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1951, *74*, 87–91.

Calcium deposits occur most frequently in cataracts secondary to other diseases of the eye, particularly after perforating wounds, and occasionally after contusions of the eyeball or inflammations. The calcium deposition starts in the periphery of the necrotic tissues of the over-ripe cataract, and progresses centrally, years passing before the deposit is roentgenographically demonstrable. If vascular granulation tissue penetrates the avascular lens, lamellar bone may be laid down, but this cannot be roentgenographically differentiated from amorphous calcium deposits.

The typical picture is a rounded, pea-sized calcification in the axial view, and an elliptic calcification in the anterior portion of the globe in the lateral view, with dense margins. If the lens is atrophic and contracted, the outline may be irregular.

Differential diagnosis must include: choroidal calcification which appears as a larger hemispheric shell, open anteriorly and located in the posterior portion of the globe; calcifications in the vitreous body which form irregular flecks, not reproducing anatomical contours; and calcified tumors or parasites, which are also usually irregular in outline—*J. J. B. Light, M.D.*

Sutton, David. Intracranial calcification in toxoplasmosis. *Brit. J. Radiol.*, Jan., 1951, *24*, 31–37.

Toxoplasma has been known in animals for a long time, but only recently has its pathogenicity for man been established. The disease may be latent or active; many of the cases are congenital, and are transmitted from carrier mothers. The characteristics of the disease are chorioretinitis, mental defect, convulsions, elevated protein in the cerebrospinal fluid, intracerebral calcium deposits, and in adults, pneumonitis and a typhus-like rash. In many cases only one or two of these characteristics may be present, and one of the most important is chorioretinitis. Toxoplasmic retinopathy may be the only manifestation. The only positive means of establishing the diagnosis is demonstration of the organism in body fluids or in human tissue obtained by biopsy or autopsy. The organism grows in laboratory animals. Specific antibodies exist in the blood serum and, in the presence of a typical clinical picture, positive serum tests are usually accepted as proof. Demonstration of antibodies in the serum of the mother of an affected infant may be of great diagnostic value.

Intracerebral deposits of calcium are a fairly constant part of the picture, and were absent in only 7 out of a series of 45 cases. The author presents 6 cases, all of which show calcification. A single calcium deposit may be present, varying from a discrete rounded focus to a linear flake; or there may be multiple shadows, and this is more frequent. Some cases show numerous subcortical flakes and also linear and curvilinear streaks which may be in the basal ganglia. One recorded case showed symmetrical granular calcification in the region of the basal ganglia; another, streaky unilateral calcification in the parietal area; another, many discrete intracerebral nodules.

With multiple subcortical flakes of calcification, torulosis must be considered, but the clinical picture is usually distinguishing. Also, the curvilinear streaks are quite characteristic of toxoplasmosis. Other causes of intracranial calcification, such as hypoparathyroidism, angioma, tuberous sclerosis, cysticercosis, and arteriosclerosis, all have different types of calcification or markedly different clinical appearances, or both. When the calcium deposit is single, the differentiation is more difficult. Unusual density or a curvilinear configuration suggests toxoplasmosis.—*E. F. Lang, M.D.*

Weingraber, H. Die Funktionsprüfung in der Röntgenfrühdiagnostik der Kiefergelenkserkrankungen. (The functional test in the early diagnosis of diseases of the temporomandibular joint.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1951, *74*, 84–86.

Limitation of movement of the head of the mandible is the earliest roentgen sign of temporomandibular joint disease, and is demonstrated most clearly on laminagrams of the joint made with the mouth wide open and with the mouth closed.

Two operative cases are reported: one with adhesions of the articular disc, capsular thickening, and erosion of the articular cartilage of the head, and the other with a polypoid degeneration of the articular disc. Both obtained relief following removal of the disc.—*J. J. B. Light, M.D.*

Lewin, Walpole, and Cairns, Hugh. Fractures of the sphenoidal sinus with cerebrospinal rhinorrhoea. *Brit. M. J.*, Jan. 6, 1951, *1*, 1–6.

The authors discuss cerebrospinal rhinorrhea following closed head injuries with fractures involving the paranasal sinuses. In a series of 84 cases of cerebrospinal rhinorrhea a dural tear over the sphenoidal sinus was found in 11 instances and was the only tear in relation to the paranasal sinuses in 5. It is borne out that the proximity of these dural tears to the cisterna chiasmatica may be helpful in establishing the correct diagnosis, which is difficult at best. Profuse rhinorrhea is characteristic of tears in this location and is not a frequent finding in rhinorrhea caused by frontal and ethmoidal fractures. The roentgenographic demonstration of air in the cisterna chiasmatica is also another helpful finding in establishing the diagnosis. Operative repair is urgently indicated and difficult. Three of their 5 patients underwent successful dural repair and have been followed for nearly four years.—*W. C. MacCarty, Jr., M.D.*

Givré, Alfredo. La radiología de los tumores del nervio acústico. (Roentgenology of acoustic nerve tumors.) *Prensa méd. argent.*, Jan. 26, 1951, *38*, 199–208.

The roentgenological findings of 300 cases of acoustic nerve tumors are summarized. All of these cases had been operated upon in the clinic of Prof. Herbert Olivecrona in Stockholm during the years 1922 to 1947. Both modifications in bone and alterations in ventriculograms were reported. The routine examination of the head consisted of roentgenograms taken in eight projections, particular stress being placed on the frontodorsal, axial and fronto-ortho projection (frontolateral ortho projection). In the latter, the roentgen-ray beam is directed to the external border of the orbit 10 degrees caudad, and 30 degrees backwards.

Alterations were found in the (1) internal auditory meatus; (2) porus acusticus; (3) apex of the petrous portion of the temporal bone; (4) sella turcica; (5) foramen magnum; and (6) there was evidence of increased intracranial pressure. The degree of bone change in the meatus and porus acusticus was graded as I, II, III, with III showing a very marked

bone destruction. Attention is called to the destructive changes in the porus in which a defect appears in the shape of a cask.

Twenty-one per cent of the cases showed roentgen changes attributable to the eighth nerve tumor. Atrophy of the sella turcica was found in 32 per cent and atrophy of the ridge of the foramen magnum in 14 per cent.

The typical changes of cerebellar pontine angle tumors in ventriculograms were: (1) deviation of the aqueduct in a lateral posterior portion of the floor of the third ventricle with lateral deviation of the fourth ventricle and dilatation of the lateral and medial ventricle. The alterations in the ventriculograms were considered to be in direct relation to size of the tumor and the direction in which it was extending. Twenty-three of 26 ventriculograms showed positive evidence of a cerebellar pontine angle tumor. In locations where an acoustic tumor was strongly suspected but could not be demonstrated by pneumoventriculography, 2 cc. of lipiodol was added to the contrast medium for ventriculography. The elevation of the floor of the occiput and prolongation of the ventricle described by Stone and Schulze was found infrequently.—*M. M. Friedman, M.D.*

Sugar, Oscar. Pathological anatomy and angiography of intracranial vascular anomalies. *J. Neurosurg.*, Jan., 1951, *8*, 3–22.

Dorcus Hager Padget has pictured and described the changes in development of the cranial arteries of human embryo in a beautiful monograph which is an amplification of the chapter written for Dandy's book on intracranial aneurysms. Some of the anomalies of the adult cerebral vascular tree are thereby rendered more comprehensible.

The basilar artery is formed by fusion of the two longitudinal neural arteries under the neural tube in the early embryo. At the line of fusion one might expect medial defects to occur, and such opposing deficiencies have been described in the basilar artery of the child of thirteen weeks whose case was reported by Forster and Alpers. The aneurysm in this case was at the bifurcation of the basilar into the posterior cerebral arteries. An exactly similar bulge was depicted in a human embryo of forty-two weeks by Bremer—surely the earliest "berry aneurysm" known. Since these long vessels fuse by growing toward one another and by capillary connections which later disappear, it would not be difficult to assume that relicts of these vessels could expand into other basilar aneurysms not at the bifurcation.

Another vessel, the primitive vertebral basilar anastomosis, normally disappears when the vertebral arteries form by fusion of cervical segmental arteries and come to join the basilar artery in the midline. Persistence of such an artery or its early branches might well account for the location of an aneurysm well to one side of the basilar artery, such as has been described by Schwartz.

The primitive trigeminal artery is the earliest communication between the carotid and basilar systems. With establishment of the posterior communicating artery (which in the embryo is one of the 2 basic termini of the internal carotid artery), this vessel dwindles and disappears. Occasionally it persists in the adult as a large artery passing between the internal carotid artery in the cavernous sinus and basilar artery in the region of the trigeminal nerve roots. In this event the vertebral artery on that side (or both vertebral arteries) may be considerably reduced in size. When it does not persist there may arise at its site of embryonic origin, an aneurysm (be it by persisting medial defect not at a bifurcation, or by nubbin of residual vessel). This is the aneurysm of the cavernous portion of the carotid artery. This area may also be the weak spot which predisposes to traumatic or "spontaneous" rupture of the carotid artery in the formation of a carotid-cavernous fistula. Some such explanation is necessary to understand why the normally thick-walled strong carotid artery should break just here, surrounded by a much thinner-walled sinus containing venous blood. Reflux into the fistula from the contralateral carotid artery has been demonstrated, often requiring intracranial ligation of the internal carotid artery in addition to tying it off in the neck. If a clip is placed intracranially distal to the exit of the ophthalmic artery, the fistula may continue to be fed from the external carotid artery. This occurs as follows:

From the second gill arch artery arises a vessel which ultimately becomes the hyoid-stapedial artery The stapedial portion grows up to the eye and supplies the orbit, fusing with branches of the ophthalmic artery. Later, the orbital branches are taken over by the internal maxillary division of the external carotid artery, and the stem of the stapedial artery ordinarily disappears, leaving only a small hyoid remnant, the caroticotympanic branch of the adult. Occasionally, the stapedial artery persists in the adult. Eventually, the ophthalmic artery takes over the orbital branches, but the communications with the internal maxillary may persist, and allow transfer of blood from the external carotid artery to the intracranial portion of the internal carotid artery. Such pathways may be more effective than the posterior communicating artery in supplying the intracranial carotid circulation as in cases of bilateral occlusion of the internal carotid artery by endarteritic processes. Angiograms of the connections between ophthalmic (internal carotid) and lacrimal (external carotid) arteries have been shown by Marx.

Another feature of growth of the circle of Willis is the large size of the posterior communicating artery in the embryo, arising directly as a division of the internal carotid artery. It usually dwindles to a small connection with the posterior cerebral artery which typically comes off the basilar artery in the adult. The communicating vessel may, however, persist as the main stem of the posterior cerebral artery which then arises from the internal carotid artery.

The ophthalmic artery has an origin of interest in

relation to vascular anomalies. The eye is first lateral to the brain proper and is supplied by primitive ventral and dorsal ophthalmic arteries. The ocular supply of these vessels is taken over by the definitive ophthalmic artery, which starts near the bifurcation of middle and posterior cerebral arteries and wanders down the internal carotid by a series of anastomotic loops to its position under the optic nerve. The ventral and dorsal ophthalmic arteries usually disappear but remnants may be responsible for lateral and medial aneurysms of the internal carotid artery between the ophthalmic and posterior communicating vessels of the adult. Such aneurysms often appear as elongated masses rather than as spherical or saccular lesions, and may be produced by ruptures of the ends of vestigial vessels. There are numerous embryonic vessels in this region; some later pass to the hypophysis and others may give rise to aneurysms. Persistent embryonic remnants may also be the cause of aneurysms which appear far out in the periphery.

The network of vessels connecting the two anterior cerebral arteries is often a complicated plexus and the origin of aneurysms from this area has been elaborated on by Bassett.

Angiography in vascular anomalies such as Sturge-Weber disease and in arteriovenous malformations indicate that dilated pial venous channels are the basic lesion in Sturge-Weber disease.

The arteriovenous malformations have a predilection for the rolandic area. Sometimes what appear to be typical saccular aneurysms develop in relation to such masses. These may be true or false aneurysms and may show calcification in the wall.

Although the hemangioblastomas of the brain are classified as tumors, they appear to be on an embryologic basis, and sometimes definite vascular anomalies are associated with them. The best known of these is the retinal anomaly of v. Hippel. Vascular anomalies occurring in the cerebrum may cause focal seizures in patients with cerebellar hemangioblastoma.—*A. B. Smith, M.D.*

Scott, Wendell G., and Seaman, William B. Developments in cerebral angiography with rapid serialized x-ray exposures on roll film 9½ inches wide. *Radiology*, Jan., 1951, *56*, 15–30.

One of the most important advances in the technique of cerebral angiography has been the mechanization and automatization of roentgenographic equipment for the production of serial roentgenograms of opaque medium in the cerebral vessels.

A device termed the "rapidograph" designed and produced by the authors is described. It consists of a magazine of a Fairchild aerial camera using 9½ inch wide roll film and adapted to a self cocking rapid Potter-Bucky grid. Exposures are made at one-twentieth of a second at the rate of two a second. To further facilitate proper examination, a double rapidograph has been assembled so that anteroposterior and lateral serial roentgenograms may be taken simultaneously.

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The technical aspects of cerebral angiography are apparently well taken care of by this new apparatus, but further work must be done to find a less dangerous contrast medium.

There are 33 illustrations portraying the apparatus, technique of injection and roentgenograms of various intracranial conditions demonstrated by cerebral angiography.—*C. A. Stevenson, M.D.*

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The authors performed cerebral angiograms on 3 cases of mentally retarded children. These cases had carotid-jugular anastomoses done by the technique described by Beck, McKhann and Belnap. Pre- and postoperative findings are reported to assess the changes in cerebral arterial blood flow.

They found that the fistula did not increase the number of visible blood vessels, especially arterial vessels, in the angiograms. The chief effect as observed in all cases was to direct the blood from the right common carotid artery to the internal jugular vein and thence to the right transverse sinus. From there it crossed to the left transverse sinus and then to the left jugular vein.

It was noted that the veins of the skull and scalp became enlarged, especially the retrobulbar. This produced proptosis in 1 case which was immediately relieved when the anastomosis was discontinued.

The authors feel that these studies do not support the optimism that this operation will increase the blood supply to the brain.—*Norman Heilbrun, M.D.*

Ray, Bronson S., Dunbar, Howard S., and Dotter, Charles T. Dural sinus venography as an aid to diagnosis in intracranial disease. *J. Neurosurg.*, Jan., 1951, *8*, 23–27.

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They found that the fistula did not increase the number of visible blood vessels, especially arterial vessels, in the angiograms. The chief effect as observed in all cases was to direct the blood from the right common carotid artery to the internal jugular vein and thence to the right transverse sinus. From there it crossed to the left transverse sinus and then to the left jugular vein.

It was noted that the veins of the skull and scalp became enlarged, especially the retrobulbar. This produced proptosis in 1 case which was immediately relieved when the anastomosis was discontinued.

The authors feel that these studies do not support the optimism that this operation will increase the blood supply to the brain.—*Norman Heilbrun, M.D.*

Ray, Bronson S., Dunbar, Howard S., and Dotter, Charles T. Dural sinus venography as an aid to diagnosis in intracranial disease. *J. Neurosurg.*, Jan., 1951, *8*, 23–27.

The special methods of investigation of the intra-

cranial venous system have brought to light some interesting facts and proved of practical use. They may possibly introduce a new avenue of investigation that will prove valuable not only in intracranial tumors but in other conditions that alter the intracranial veins.

The methods employed include (a) direct injection into the superior sagittal sinus of a contrast medium through a catheter introduced into the sinus; (b) retrograde injection of a contrast medium through a catherer introduced into the basilic vein of the arm passed upward into the internal jugular vein to the superior bulb; and (c) direct measurement of the venous pressure.

In the normal the contrast medium rapidly passes back through the longitudinal sinus, thence into the transverse sinuses and internal jugular veins. The other dural sinuses and the cerebral veins are not visualized.

Compression of one or both jugular veins for fifteen seconds does not usually cause the contrast medium to pass into the cerebral veins nor alter the relative degree of filling of the transverse sinuses. It does, however, result in extensive filling of the occipital and vertebral system of veins.

The relative size and filling of the transverse sinuses in a group of 12 normal patients were evaluated. In 3 cases the transverse sinuses filled equally well and were of the same approximate size. There was complete absence of filling of the left transverse sinus in 1 case and of the right in 1 case. In the remaining cases there appeared to be a predominance in size of one or the other of the transverse sinuses in a nearly equal ratio. These findings indicate that while the superior sagittal sinus often drains more, and occasionally wholly, into one transverse sinus, there is not an impressive dominance of the right over the left. This is not in keeping with the commonly accepted statement that the right transverse sinus predominantly receives the flow from the superior sagittal sinus. Experiences with a larger series of cases will be necessary to throw more light on the matter.

Retrograde jugular venography with the catheter at the superior bulb of the internal jugular vein showed good filling of the superior and inferior petrosal sinuses and less often of the cavernous and transverse sinuses of the same side. There was also good filling of the vertebral, orbital and facial veins and of the pterygoid plexus. The exact extent of filling in the normal is not yet clear but it appears that there should be filling at least of the petrosal and cavernous sinuses and the vertebral and pterygoid plexuses of veins.

The normal venous pressure in the superior longitudinal sinus was between 120 and 150 mm. of water, a pressure comparable to that of the cerebrospinal fluid. Straining or temporary occlusion of the jugular vein caused a prompt rise in the venous pressure in the sinus and a prompt fall on release of pressure. Compression of the jugular vein on the side where the transverse sinus was occluded did not alternate the pressure in the sagittal sinus but sometimes caused it to fall. Studies attempting to correlate the rate and degree of rise of sagittal venous pressure on jugular compression with the relative sizes of the transverse sinuses demonstrated the more prompt and greater rise when compression was made on the side of the larger sinus.

Abnormal patterns of the intracranial venous system following injection of contrast medium into the superior sagittal sinus occurred in cases of neoplasm (meningioma, fibrosarcoma) invading the sagittal sinus and transverse sinus; thrombosis of the sagittal and transverse sinuses, and following ligation or resection of one transverse sinus.

More observations are needed of patients with and without intracranial disease before normal variations in the filling of the venous system can be established and the abnormal patterns evaluated. In the normal, injection of the superior sagittal sinus or internal jugular vein can be expected to outline the major venous sinuses but not the cerebral veins, the deep venous system, veins of Galen, inferior sagittal or straight sinuses. These veins can sometimes be visualized in the "venous phase" after injection of the carotid artery, and the two methods of visualization of the intracranial venous system can be used to supplement each other.

At present it appears that the most important practical use of the methods here described is the demonstration of partial or complete obstruction of the superior sagittal or transverse sinuses. It aids in the treatment of neoplasms and provides more accurate diagnosis in cases of thrombosis.—*A. B. Smith, M.D.*

Dunsmore, Rembrandt, Scoville, William Beecher, and Whitcomb, Benjamin Bradford. Complications of angiography. *J. Neurosurg.*, Jan., 1951, *8*, 110–118.

The short history of cerebral angiography reveals a constant search for an inert, more miscible contrast medium that is devoid of untoward size reactions. Egas Moniz carried out all angiography with 25 per cent iodide until 1931, with a mortality rate of between 2 and 3 per cent. Thorotrast was introduced about this time and became popular on the Continent but the potential danger of radioactivity has limited its use in this country. Gross introduced diodrast in 1939 and the 35 per cent solution is now perhaps the most widely used of the contrast media. Relatively few complications with this substance have been reported in the literature and in Torkildsen's recent monograph on 2,000 cases of angiography, no major complications nor deaths have been listed.

The authors wish to emphasize the potential hazards of diodrast angiography. In a series of 147

carotid angiograms performed with 35 per cent diodrast on 108 patients, complications occurred in 14 of the 108 cases. Of 7 major complications, there were 3 deaths and 4 residual permanent partial paralyses. The 7 minor complications included 2 cases of transitory hemiplegia, 2 of convulsions, 1 case of carotid artery thrombosis, 1 of injury to the cervical sympathetic chain by needle puncture, and 1 case of diodrast skin sensitivity.

The authors state that cerebral angiography contributed, at least in part, to the cause of death in the 3 cases. Case 1, aged thirty-five, with marked kidney pathology, died of respiratory failure twelve hours after angiography and a 250 cc. hematoma was found in the neck at autopsy. Case 2, aged sixty-five, with a recent fracture of the femur, had bilateral carotid angiography, a total of 70 cc. of 35 per cent diodrast being used, and two days later a left carotid angiogram with 50 cc. of 35 per cent diodrast. She died approximately thirty-six hours later, and autopsy revealed a large sphenoid wing meningioma engulfing the left internal carotid and part of the left middle cerebral artery, with a large fresh hemorrhagic and necrotic area in the cortex along the distribution of the left middle cerebral artery. Case 3, aged fifty-four, had a seven year history of alternating hemiplegia, previous ligation of the left common carotid artery and another total left hemiplegia on the day of admission. Right carotid angiography with 35 per cent diodrast was done, the patient immediately became unconscious and remained so till death occurred twelve days later. Autopsy revealed multiple recent and old infarcts of the brain and some generalized brain atrophy.

It would seem that in these 3 cases the procedure of angiography was of considerably more importance than the type of contrast medium used. It also emphasizes the authors' conclusions that the older age group, especially those with thrombotic tendencies or other evidence of impaired cerebral circulation are most likely to develop complications. Cerebral thrombosis, secondary to irritative vasospasm from the contrast medium used, is suggested as the pathologic etiology. The rationale of both treatment and prophylaxis in complications of angiography appears to lie in relief of vasospasm.—*A. B. Smith, M.D.*

Neck and Chest

Potts, Willis J. Congenital atresia of the esophagus with tracheoesophageal fistula. *J. Thoracic Surg.*, Nov., 1950, *20*, 671–680.

Of all operable congenital deformities seen in the newborn infant none is associated with more difficulties than congenital atresia of the esophagus with tracheoesophageal fistula. The infant is usually underweight and often premature. By the time the diagnosis is made many of the infants have an aspiration pneumonia or atelectasis. The operative repair is long and tedious. For these reasons the mortality rate remains rather high.

This is a report on 35 cases of congenital atresia of the esophagus. Thirty-two were of the common variety, that is, atresia of the upper end of the esophagus and a fistulous communication of the lower end of the esophagus with the trachea at or near the carina. Three of the infants had congenital atresia of the esophagus without tracheoesophageal fistula. In 25 infants the fistula was closed and the ends of the esophagus anastomosed. Eleven patients survived the operation and 10 are well and thriving three months to three years following operation.

The early diagnosis before pneumonia and/or atelectasis is important and the possibility should be considered in all newborn children who breath poorly after birth, have excessive mucus in the mouth and throat, and have cyanotic spells during the early hours after delivery. Unsuccessful attempts to pass a catheter through the esophagus in such a case should arouse suspicion of congenital obstruction. Confirmation of the deformity is established by the introduction of 2 or 3 cc. of lipiodol through a catheter into the blind pouch. If in the presence of atresia there is air in the gastrointestinal tract, a diagnosis of atresia with tracheoesophageal fistula is made. With no air in the gastrointestinal tract a diagnosis of atresia without fistula is made.—*T. C. Stansbury, Jr., M.D.*

Sautter, H. Der isolierte "Basedow"-Exophthalmus. (Isolated "Basedow" exophthalmos.) *Deutsche med. Wchnschr.*, Dec. 1, 1950, *75*, 1614–1615.

The relation of exophthalmos to endocrine disease entities has not been explained satisfactorily. The earlier conception that the sympathetic nervous system through contraction of the muscles of the lids and orbit produces an exophthalmos has proved incorrect. Also, the belief that excess thyroxin in the blood in thyrotoxicosis may be the cause of exophthalmos has been unsubstantiated. Recent studies reveal that the cause of exophthalmos is the thyrotropic hormone of the anterior pituitary gland. The excretion of this hormone may produce a hyperfunction of the thyroid gland and secondarily, an exophthalmos. Normally, an increase of the circulating thyroid hormone retards the production of the thyrotropic anterior pituitary hormone, and vice versa. Should the thyroid or pituitary be abnormal primarily, with the result of hyper- or hypofunction of either gland, then the hormonal regulations are severed.

Three cases are presented which may suggest the pathogenesis of "Basedow" exophthalmos. A fifty-six year old male noted gradual protrusion of the left eye for three months. Examination revealed a fine tremor of hands, a hen's egg sized thyroid gland, and a 4 mm. protrusion of the left eye. Following

orbitotomy a corneal ulcer developed necessitating enucleation of the left eye. Four months after the original examination, the right eye became prominent. Basal metabolic rate was plus 36 per cent. Roentgen therapy was given to the thyroid gland (6 sessions, 120 r) and to the pituitary (8 sessions, 320 r). Almost nine years later, only a slight exophthalmos remained with almost normal vision of the right eye. Another patient, with a slightly enlarged thyroid gland, had bilateral moderate exophthalmos. Basal metabolic rate was normal. Thiouracil treatment was of no benefit. Roentgen therapy was given to the thyroid gland (2,000 r, 10 sessions) and to the pituitary (900 r, 6 sessions). Regression of exophthalmos was noted. A forty year old female had had an enlarged thyroid gland since puberty. The right eye was prominent since fall of 1948. Basal metabolic rate was normal. Thyroidectomy was performed in December, 1949. The bilateral exophthalmos increased, the eyelids became swollen, and headaches appeared. Roentgen therapy was given to the pituitary (2,400 r, 12 sessions) and one month after admission, there was a definite regression in the exophthalmos.

The conclusion is reached that the exophthalmos in the author's cases was not the result of thyrotoxicosis but of increase of the thyrotropic anterior pituitary hormone. Roentgen therapy alone was beneficial.—*Samuel Richman, M.D.*

Woolner, Lewis B., and McDonald, John R. Cytology of sputum and bronchial secretions; studies on 588 patients with miscellaneous pulmonary lesions. *Ann. Int. Med.*, Nov., 1950, *33*, 1164–1174.

The authors present their experience with cytologic technique as a routine procedure in the investigation, over a given period, of all patients with suspected pulmonary neoplasm. During a three year period a total of 325 cases of bronchogenic carcinoma has been diagnosed by examination of sputum or bronchial secretions.

The technique is briefly reviewed. The accuracy of diagnosis is shown. A comparison of the results of bronchoscopic examination, and cytologic studies in the group with bronchogenic carcinoma revealed a much higher rate of positive findings with the latter. There was only 1 false negative noted from the cytologic method. Of 48 cases in which exploration was performed for bronchogenic carcinoma, smears were positive in 33 cases (69 per cent), while biopsy was positive in 21 (44 per cent). Of 29 cases in which resection for bronchogenic carcinoma was carried out, smears were positive in 20 (69 per cent), while biopsy was positive in 11 (38 per cent).

In order to emphasize the value of cytologic technique in routine diagnosis of chest diseases, a few cases are described in some detail. In 2 additional cases, in which roentgenograms of the chest suggested tuberculosis, no tissue proof was obtained but the presence of exfoliated cancer cells in the sputum proved convincing evidence that the lesions in question were neoplastic.

In the group reported, Pancoast's tumor was diagnosed in 8 cases, 5 of which were diagnosed correctly by the presence of carcinoma cells in sputum or bronchial washings. Bronchoscopic examination was carried out in only 2 cases, negative results being obtained in both. In 3 cases sputum was examined and found negative.

Four cases of so-called alveolar cell carcinoma diagnosed by cytologic examination of sputum or bronchial secretions have been reported previously, and the authors add 3 new cases in this study, 1 being described in detail.

To summarize, 147 cases of proved or suspected bronchogenic carcinomas occurred in a group of 588 cases of miscellaneous chest diseases in which routine cytologic examination of sputum or bronchial secretions was carried out. Of these 147 cases, 100 (68 per cent) were detected by a cytologic examination of the sputum or bronchial secretions. No known false positive diagnoses occurred in this series. Of 93 patients with bronchogenic carcinoma who underwent bronchoscopic examination a positive biopsy was obtained in 41 per cent as compared to 70 per cent having proved positive by cytologic studies.—*R. D. Moreton, M.D.*

Lentini, Sirio, and Barbieri, Pierluigi. Pneumomediastino anteriore e stratigrafia; visualizzazione del timo e dei vasi del mediastino anteriore. (Anterior pneumomediastinum and stratigraphy; visualization of the thymus and the vessels of the anterior mediastinum.) *Radiologia*, Roma, Nov.-Dec., 1950, *6*, 621–648.

This excellent article presents a technique for demonstrating the thymus and the vessels of the anterior mediastinum by combining pneumomediastinum and laminagraphy. Studies performed on cadavers and on living subjects showed the superiority of this method over the other means employed for examination of the anterior mediastinum. The use of oxygen provides good contrast for outlining the components of the anterior mediastinum while laminagraphy eliminates the confusing shadows of the sternum, vertebrae, and posterior mediastinum as well as the structures lying proximal or distal to the stratum being roentgenographed.

The technique consists of introducing a thin 10 cm. long needle (bent to a 120 degree angle near its center) above the sternal notch in the midline and passing it down 2 or 3 cm. along the posterior surface of the manubrium while the patient lies supine with the neck hyperextended. After aspiration to exclude the possibility of vessel puncture, oxygen is injected with a pneumothorax apparatus. The

quantity ranges from 75 to 400 cc., depending on the capacity of the mediastinum. The injection is discontinued when the readings become stabilized about a median of plus 5. No ill effects were noted in patients whose age ranged from two to sixty years. In many subjects the procedure was done on an out-patient basis. After the oxygen is introduced, posteroanterior laminagrams are made using cushions under the abdomen to bring the sternum flush with the table top. Beginning with a plane 3 cm. behind the anterior surface of the chest, laminagrams are made at successive 1 cm. depths back to a depth of 8 cm. or until the plane of trachea is reached in order to fully explore the anterior mediastinum. After this, left and right lateral laminagrams are made beginning in the median plane and proceeding at successive 1 cm. depths to both sides until the limits of the air pockets are reached.

The cadavers of 8 subjects who had no evidence of disease in the anterior mediastinum and who had not died from a wasting disease were examined first and the close correlation existing between the roentgenographic and the anatomic findings noted.

Then 86 living subjects were studied. The authors present reports on 7 of these representing both sexes, and including children and adults who had normal as well as enlarged thymus glands. Of these, 3 received roentgen therapy with regression of the gland.

In all cases studied, the margins of the air pocket were more clearly defined by the added use of laminagraphy. In posteroanterior views, the great veins are best seen about 1 to 1.5 cm. posterior to the plane which best shows the thymus. The superior vena cava, the brachiocephalic veins and their confluence are well demonstrated and readily recognized by their location and configuration. Occasionally, due to a perivascular extension of oxygen beyond the anterior mediastinum, the jugular and subclavian veins are also identified at the base of the neck. In some cases, a similar infiltration of oxygen outlines the arteries arising from the aortic arch, especially the innominate, even though these vessels lie in the posterior mediastinum. On lateral laminagrams, the superior vena cava and the trunk of the right brachiocephalic vein appear as vertical opacities best seen in the planes to the right of the midline. The left brachiocephalic trunk which has a largely horizontal configuration is seen as a rounded opacity in the superior part of the mediastinal shadow on laminagrams made to the left of the median plane. While the thymus may be confused with the vertical shadows of the great veins, its anterior position in the lateral view should help identify it. Furthermore, a linear radiolucency separates the thymus posteriorly from the cardiovascular shadow, whereas the great vessels can be seen to blend into the base of the heart.

The lateral view frequently shows the azygos vein with its characteristic arched configuration which is rendered visible by the infiltration of the posterior mediastinum by small amounts of oxygen.

The greatest surface of the thymus is seen in the posteroanterior projection. It is encompassed by the heart below and the left brachiocephalic trunk above although it occasionally extends up into the base of the neck. Sometimes it extends more to the right of the midline and sometimes more to the left. It has a variable contour which is rendered even more variable by the pneumomediastinum which elevates and displaces the gland anteriorly and alters its relationship to the other mediastinal structures. In the normal prepuberal cases presented, the organ was bilobed and resembled an inverted crescent. In the lateral view it resembled an opaque vertical band lying in close proximity to the great vessels and the base of the heart. In some cases both the upper and lower borders were visible; in others, the superior margin was lost in the neck shadow, usually representing a cervical extension of the gland as demonstrated on posteroanterior films.

The image of the thymus varies even more considerably on the lateral films, but its anatomy and relationships can be reconstructed by correlating the findings in both lateral and posteroanterior laminagrams made with pneumomediastinum.

In normal adults, the thymus was not lobed, although its appearance was similar to that noted before the physiological regression, except that it was less opaque and its margins were less distinct. Studies on cadavers which showed adipose tissue replacing the atrophic gland, supported these observations.

In prepuberal subjects with thymic hypertrophy, the gland was clearly seen. It usually appeared bilobar although at times the lobes were fused. A cervical extension was seen in some cases. Adults with thymic hypertrophy showed an organ which was not lobed and which was draped across the base of the heart as an inverted crescent. Hypertrophy rendered the gland more opaque. In lateral laminagrams the appearance varied more than in normal subjects, but usually there was a thicker upper part, located in the angle formed by the great vessels and the base of the heart, and an elongated vertical portion running parallel with and in front of the cardiac shadow.

Progressive reduction in the size of the gland observed in repeated examinations following roentgen therapy was confirmatory evidence that the shadow initially seen was that of the enlarged thymus. Roentgen therapy when used was given with doses of 100 r every other day for five or six treatments. This cycle was repeated two or three times with an interval of twenty days between each cycle. The technical factors are not included in the article.

In conclusion, the authors feel that the technique described possesses the following advantages over pneumomediastinum alone:

1. It permits visualization of the thymus even in normal subjects and in adults; thus hyperplasia or persistence of the thymus can always be detected.
2. It permits differentiation of the thymus from its residue in the adipose-connective tissue.
3. It permits separation of the thymus from the great vessels.
4. It permits study of the great veins.

Owing to these advantages the authors suggest that the method be used in the following conditions: mediastinal pathology, including tumors; study of the dynamics of the great vessels in normal or disease states, especially those affecting the right heart as, for example, stenosis of the pulmonary artery; study of the part played by the thymus in relation to growth, sexual development, the lymphatic system, the endocrines, the composition of the blood, changes in nucleoproteins, the alarm reaction and the syndrome of adaptation; determination of the role of the thymus in certain pathologic conditions such as thymic hypertrophy, Addison's disease, thyrotoxicosis, myasthenia gravis, leukemia, Hodgkin's disease, status thymicolymphaticus and sexual under-development.

The first example of usefulness of the method has already been given by demonstrating hypertrophy of the thymus in patients in whom this condition while clinically suspected was not detectable by other means and by observing the changes obtained in the thymus following roentgen irradiation.—*C. Colangelo, M.D.*

Condorelli, L., Turchetti, A., and Pidone, G. Il pneumomediastino posteriore. (Posterior pneumomediastinum.) *Ann. radiol. diag.*, 1951, *23*, 33–54.

This article describes a technique for injecting air into the posterior mediastinum for better roentgenographic visualization of the structures located in this part of the chest. A needle, with a bore 1 mm. in size and 10 cm. long with a stylet, is inserted in the anterior region of the neck about 3 cm. above the manubrium. The needle is passed through the anterior and posterior walls of the trachea so that the point of the needle lies within the areolar tissues between the trachea and the esophagus. With the needle in this position about 150 to 300 cc. of air is slowly injected using a pressure of about 20 cc. column of water. Air pressure in the posterior mediastinum which normally measures from −5 to +5 on respiration, rises to a level of +10 after injection of air. Air injected into the mediastinum is stopped when the pressure rises to +10 regardless of the amount of air that has already been injected.

These studies were done on normal persons and the following films were taken on all cases: routine chest films in the posteroanterior, lateral, left and right oblique positions; next, lateral laminagrams at 5 mm. levels up to 5 cm. from either side of midline; finally, laminagrams in the anteroposterior position, again at 5 mm. levels beginning with the level behind the sternum down to the vertebral column.

The authors found that in many cases, although most of the air was contained in the posterior mediastinum, a small amount of air would escape into the anterior mediastinum. It was also found that the air in the posterior mediastinum took a constant pattern in these normal patients. The films taken in the various positions more clearly defined many of the mediastinal structures, especially the arch of the aorta, pulmonary arteries and veins, the superior and inferior vena cava, the large main bronchi and the posterior heart chambers.

With the experience and knowledge gained in normal subjects, the authors now feel prepared to use this procedure in pathological cases. The article contains many beautiful illustrations of films taken in the various positions and with different techniques. A diagram showing transfixation of the trachea with the needle in place for injection is included.

The authors have developed an excellent method for more detailed visualization and study of the structures contained in the posterior mediastinum. They have made a valuable contribution to the anatomy and physiology of the posterior mediastinum.—*P. E. Russo, M.D.*

Gil y Gil, Carlos. Über die Röntgendiagnostik des Sternums. (Roentgen diagnosis of the sternum.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1950, *73*, 759–764.

Roentgenography of the sternum has increased in importance with the advent of sternal puncture. The author describes a new roentgenographic projection which reveals bone detail not afforded by conventional views. Essentially, the patient lies on his side, on the Bucky table, and is rotated ventrally 25 degrees. The central ray is perpendicular to the film and passes through the anterior axillary line at the level of the second intercostal space. This actually is an oblique projection but affords greater detail because of less overlying tissue. A variation of this position is made by rotating the tube so that the central ray is 25 degrees from a line perpendicular to the film, the patient lying on his side. A second variation is the use of the upright position, with the roentgen beam horizontal. Seven illustrations are shown, some with pathologic changes.—*L. A. Nash, M.D.*

Freedlander, Samuel O., Wolpaw, Sidney, and Mendelsohn, Harvey J. Surgical experience with asymptomatic intra-thoracic growths. *Radiology*, Nov., 1950, *55*, 700–711.

This is a report of several cases of solitary intra-

thoracic tumors found during routine chest surveys. The patients were usually asymptomatic and surgical exploration was necessary to make a proper diagnosis. The authors emphasize that many intrathoracic lesions will give rise to few if any symptoms and can only be detected by chest roentgenography. They emphasize that, with the exception of midmediastinal lesions which may be lymphoblastoma, roentgen therapy may lead to dangerous delay in the removal of early lung malignancies.

Among the tumors found in this group of asymptomatic individuals were ganglioneuroma, lung cyst, meningocele, leiomyofibroma, teratoma, carcinoma, thymoma, tuberculoma, adenoma, fibroma, and hamartoma.—*C. A. Stevenson, M.D.*

Buchtala, Victor. Das zentral bedingte Lungenödem. (Centrally caused lung edema.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1950, *73*, 702–712.

The author presents 15 cases of lung edema which are believed to be caused by increased permeability of the pulmonary vessels due to a reflex from the diencephalon. Two types of centrogenous edema were observed: a latent type, giving no specific symptoms, and a clinically manifest type.

In cases of latent edema, a diffuse haziness was seen on the chest films, usually most pronounced around the hilar regions and in the mid lung fields. Patchy opacities from a few millimeters to 2–3 cm. in diameter were found in more advanced cases. Extension of the edema was towards the lung bases; the apical areas were involved in fatal cases.

The cases are presented with a short history and reproductions of the roentgenograms of the chest. Cases due to exposure to ice-cold water, to severe brain injuries, increased intracranial pressure caused by brain tumor, compression of the chest, and a case of recurrent pulmonary edema following epileptic seizures are reported. A case, in which the pull on the esophagus during an abdominal operation in an attempt to free adhesions caused an acute reflex pulmonary edema, subsiding after thirty minutes is also included.

The etiology is, in some cases, a direct irritation of the brain, in others a reflex from the periphery, as in exposure to cold water, crush injuries to the chest, etc.

The roentgenologically visible changes appeared rapidly, a few minutes to a few hours after the injury and cleared up completely in twenty-four to seventy-two hours.—*K. E. Matzinger, M.D.*

Björk, Viking Olov, and Salén, Ernst F. The blood flow through an atelectatic lung. *J. Thoracic Surg.*, Dec., 1950, *20*, 933–942.

Experimental atelectasis was produced in dogs with the aid of a Carlens double lumen catheter for bronchospirometry, each lung breathing separately. The blood flow through the atelectatic part of the lung was demonstrated by angiocardiography and the arterial oxygen deficit was determined. Studies were made in acute atelectasis and at various intervals up to eight month atelectasis.

In an acute atelectasis the pulmonary arteries do not become smaller, and the capillary bed remains open as indicated by contrast medium simultaneously filling pulmonary arteries and veins on both sides. The contrast filling of the periphery of the atelectatic lung is at least as pronounced as on the other side. An approximately equal arterial oxygenation deficit with complete atelectasis of one lung as compared with the same lung breathing 100 per cent nitrogen is found. This indicates that the decrease of blood flow due to an acute atelectasis is of the same order as that due to the increased resistance in the capillary bed of a lung breathing 100 per cent nitrogen. Still a considerable amount of blood is passing through the non-ventilated area in the acute stage of an atelectasis.

The blood flow through an atelectatic area is continuously decreasing during the first month, until practically no blood is passing through the non-ventilated part of the lungs. At the same time there is no decrease in size of the main branches of the corresponding pulmonary artery. Therefore, the blood flow is thought to be shut off in the capillary bed, which is gradually closing down.

In a long-standing atelectasis the pulmonary artery will decrease somewhat in size. The contrast medium does not disappear from the artery in the atelectatic part in the same time as on the healthy side, nor are the pulmonary veins filled with contrast medium in the atelectatic part at the same time as on the healthy side. The blood, therefore, is considered to fill out the arteries of the atelectatic lung but to pass either not at all or extremely slowly through the capillary bed. The capillaries are considered to be closed down in the same way as in a resting part of an organ.—*T. C. Stansbury, Jr., M.D.*

Nemir, Rosa Lee, Heyman, Arthur, Gorvoy, J. D., and Ervin, Edmund N. Pulmonary infiltration and blood eosinophilia in children (Loeffler's syndrome). *J. Pediat.*, Dec., 1950, *37*, 819–843.

The authors describe two varieties of the so-called Loeffler's syndrome. The first is characterized by a short benign course with transitory pulmonary infiltrates, eosinophilia, and few symptoms. The second variety is characterized by greater severity of the symptoms and a more chronic course. A third type has been described by Kartagener with mild symptoms but a more chronic course than in the original group described by Loeffler.

The allergic nature of the entity has been stressed repeatedly. The more recent literature emphasizes the importance of helminthiasis in the production

of the syndrome. Twenty-four of 51 cases studied by Loeffler had positive Mantoux tests.

The authors report 8 cases of Loeffler's syndrome, 5 of which had the picture of the syndrome originally described by Loeffler. The other 3 were of the chronic variety, with symptoms persisting for months. Four of the cases had positive skin tests for tuberculosis, and 3 were mistakenly diagnosed as miliary tuberculosis. Intestinal parasitism was found in 7 of the 8 cases. Improvement in these cases was rapid following treatment for the intestinal parasite making the differential etiological diagnosis clear. Two patients had relapses following recurrent finding of ova in the stools after negative examinations.—*R. M. Harvey, M.D.*

Vorwald, A. J., Dworski, M., Pratt, P. C., and Delahant, A. B. BCG vaccination in silicosis. *Am. Rev. Tuberc.*, Nov., 1950, *62*, 455–474.

It is well established that silicosis decreases resistance to pulmonary tuberculosis. Approximately 65 per cent of silicotics who come to autopsy show evidence of active tuberculosis. It would seem logical that the high incidence might be lowered by BCG vaccination of tuberculin-negative individuals exposed to a silica hazard. However, in the present study, in which the authors observed the course of infection with the BCG organisms in guinea pigs inhaling silica, it is demonstrated that a progressive and fatal pulmonary tuberculosis can develop. Accordingly, BCG vaccination would appear to be contraindicated in persons who might have an increased susceptibility to tuberculosis by reason of factors such as exposure to quartz dust. Caution is urged, however, in any attempt to interpret their results in terms of human experience.—*Hugh Caumartin, M.D.*

Schmid, Paul Ch. Über die segmentale Anordnung schrumpfender Lungenabschnitte mit Bronchektasenbildung. (On the distribution of shrunken lung segments with bronchiectases.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1950, *73*, 689–702.

Shrinking of entire lung lobes or segments of lobes with bronchiectasis formation is found in childhood following frequently a primary tuberculous infection. This is due to a temporary or permanent occlusion of a corresponding bronchus either by pressure from enlarged hilar lymph nodes or by penetration of caseous material from a tuberculous node into the bronchial lumen.

In infants, the main bronchus or one of the lobar bronchi can be easily compressed. In older children these have more rigid walls and the segmental bronchi are involved. The atelectasis can clear up completely, but if infection supervenes, a pneumonic process which heals by shrinking and bronchiectasis is a usual sequel. The remnants of the shrunken segment are seen on the roentgenogram as triangular or strand-like shadows with the apex at the hilus. A typical honey-comb pattern can sometimes be seen but often bronchography is necessary to establish the diagnosis of bronchiectasis.

The bronchiectases in the upper segments are often cylindrical. In the lower segments they tend to be saccular, due to incomplete drainage. Laminagraphy is also often of help in establishing the diagnosis.

The article brings out clearly the mechanism and etiology of bronchiectasis formation in primary tuberculosis in children. It is illustrated with reproductions of 24 well chosen films, including plain films and bronchograms. The author believes that precise diagnosis will help to establish indications for more limited surgical procedures than the lobectomies or pneumonectomies used at the present time.—*K. E. Matzinger, M.D.*

Hyde, Bernard, and Hyde, LeRoy. Spontaneous pneumothorax—contrast of the benign idiopathic and the tuberculous types. *Ann. Int. Med.*, Dec., 1950, *33*, 1373–1377.

The authors report from a Veterans Hospital that, on a Thoracic Service of average bed capacity of 350, in a two year period there were 41 cases of benign idiopathic spontaneous pneumothorax and 10 cases of tuberculous spontaneous pneumothorax. From the hospital records, 76 cases of the former and 35 cases of the latter were studied.

The age range in each group was essentially the same, eighteen to sixty-two years in the benign, and nineteen to seventy years in the tuberculous. Of the benign group, however, almost 50 per cent fell between the ages of twenty and thirty years. Symptoms in the benign group were pain in all except 1 case, dyspnea in 83 per cent, and cyanosis in 8 per cent. Only 3 per cent gave a history of effort or trauma at onset. Of the tuberculous group, 71 per cent had pain and 77 per cent dyspnea.

Films of patients with benign pneumothorax were negative for pulmonary disease, showed no pleural adhesions, and only 5 per cent showed pleural fluid above the level of the diaphragm. In the tuberculous group, all films showed pulmonary infiltration, 91 per cent showed pleural adhesions, and 54 per cent showed fluid above the level of the diaphragm.

Treatment of the benign group consisted of bed rest until the collapsed lung had re-expanded. This interval was seven weeks or less in 70 per cent of the patients. Two-thirds of the patients required four to eight weeks for complete re-expansion. In the tuberculous group, treatment was conditioned by the pulmonary infection.—*L. K. Sycamore, M.D.*

Krieger, Earl, and Lapan, Joseph. Tuberculosis in children. *Am. J. Dis. Child.*, Nov., 1950, *80*, 725–738.

This paper is a review of 100 consecutive admis-

sions to the Children's Division of the Sea View Hospital during 1949. The following features are discussed in the paper: diagnosis, vital statistics, contact history, symptoms, diagnostic procedures, constitution, pulmonary findings, extrapulmonary findings, laboratory data, course in the hospital and treatment.

The authors state that primary complex disease does not necessarily disclose both a parenchymal component and a tracheobronchial component. In over half of the cases in the primary complex group only one or the other of the two components was demonstrable by roentgenogram. In these cases the parenchymal component appeared slightly more frequently than the tracheobronchial component.

Reinfection is seen in children and frequently the distinction between primary and reinfection tuberculosis is difficult. Very few cases of progressive primary and miliary disease were observed. In almost one-third of the group showing extrapulmonary disease, no pulmonary disease was demonstrable in the roentgenograms. In the diagnosis of tuberculosis, roentgenography was the chief aid. Roentgen examination of the wrists for osseous development was performed on admission. Of 92 patients examined, 76 had normal osseous development and 16 had retarded development. No correlation was noted between osseous development and the weights of the children. Also, no correlation was noted between the osseous development and the severity of the tuberculous process. Atelectasis was definitely noted in 5 children on admission. All 5 had primary complex tuberculosis, either parenchymal and glandular components or only the parenchymal component demonstrable by roentgenogram.

The roentgen criteria for discharge from the hospital were either absence of pulmonary lesions demonstrable by roentgenograms over a period of three months, or minimal pulmonary lesions demonstrable by roentgenograms with no change over a period of six months.—*R. S. Bromer, M.D.*

O'Brien, Brendan. The treatment of tuberculous lung cavities by speleostomy. *Irish J. M. Sc.*, Sept., 1950, *6*, 409–417.

The word "speleostomy" is derived from the Greek "spélaion," a grotto, cave or cavern. The procedure consists of making an opening into a tuberculous cavity and inserting a specially prepared laminaria tent into it by means of a special trocar, under fluoroscopic and bi-plane roentgenographic control. The swelling of the tent seals off blood vessels and air passages. A wide opening is established by stretching the fistula with a series of tents of increasing size, and after an opening sufficiently large has been established, it should be possible to introduce instruments to close off draining bronchi or to insert gauze packs, which may be impregnated with antibiotics, thus bringing them into direct contact with the breeding ground of the bacillus. Secretions can be removed by suction through tightly fitting rubber tubes. It is essential that the visceral and parietal layers of pleura be firmly adherent—this is determined by exploration of the pleural space—and that the cavity be localized accurately by tomography.

The procedure is indicated in (1) tension cavities, (2) residual cavities under thoracoplasty operations, (3) peripheral cavities in lower lung fields; and (4) cavities in patients whose respiratory reserve has been so diminished by age, disease or treatment of the opposite lung as to make thoracoplasty impossible. It cannot be performed on small or multiple cavities and it is probably unsuccessful in very high apical cavities with fibrosis.

It has the following advantages: (1) By establishing a free external opening, the cavity is not subjected to the rising atmospheric pressure caused by a narrow bronchus and it can thus collapse freely around the packing. (2) The draining bronchus can be closed. (3) Antibiotics can be brought into contact with the cavity wall. (4) There is no significant bleeding in the establishment of a fistula. (5) Risk of air embolism is reduced to a minimum. (6) There is good psychological effect on the patient by avoiding a "cutting operation."

The procedure is technically difficult, and the patient must remain in the institution for a long period—six months or more. But the operative risks are slight and worth incurring in view of the hopeless nature of the disease in most patients for whom it is advocated.

While the author's results in 17 patients were only fair, 12 were still under treatment at the time of the report. He quotes Maurer with 52 patients, 49 successful in whom cavity secretions became negative and more than half of whom had returned to their homes, were leading normal lives, and working. Only 3 of O'Brien's patients might equally have been treated by radical surgery; the remainder had no choice except chronic invalidism with prospect of early death, or speleostomy.—*A. K. Wilson, M.D.*

Meschan, Isadore, and Calhoun, Joseph D. Bronchopulmonary hypogenesis; diagnosis in the living. *South. M. J.*, Dec., 1950, *43*, 1038–1042.

The authors report a single case of bronchopulmonary hypogenesis without the aid of the post-mortem examination. The patient was a thirty-eight year old white male school teacher who had been asymptomatic. The abnormal chest was discovered on routine 70 mm. films and the patient was sent to a tuberculosis sanatorium where he stayed for several months and was regarded as having tuberculosis or possibly carcinoma. When all the tuberculosis studies were proved negative, carcinoma was considered the most likely diagnosis and bronchoscopy was then recommended. The bronchoscopic study revealed the right main bronchus to end blindly about 3 cm. from its origin. The orifice of the right

upper lobe could be seen but no other openings could be visualized. Roentgenologic study of the chest showed marked shifting of the mediastinal structures into the right hemithorax with sharp angulation of the trachea to the right and compensatory emphysema of the left lung. A gastrointestinal study was carried out and the entire right colon was found to be in the chest cavity. Although the liver could not be visualized it was felt that this structure also had herniated into the chest.

There are three types of hypogenesis as submitted by Schneider:

(1) True agenesis in which there is no trace of lung bronchus or vascular supply on the affected side;
(2) Hypogenesis of a bronchus with a small outpocketing from the trachea and a rudimentary bronchus but no pulmonary tissue;
(3) Hypogenesis of pulmonary tissue with a fully developed bronchus, but this ends in a fleshy mass of areolar tissue.

The above-described case was classified as belonging to group three.

The authors have also reviewed the literature and feel that this is an unusual case in that only about 5 other such cases have been diagnosed before death.

A detailed case history and a short review of the embryological development of the lung are given.—*J. G. Snead, M.D.*

Garland, L. H., Studies on the reliability of mass x-ray surveys. *Irish J. M. Sc.*, Nov., 1950, *6*, 489–494.

The author reports briefly on the studies of two panels of experienced radiologists in the interpretation of chest films of mass roentgen surveys. Despite the experience and ability of the readers the percentage of error was surprisingly high. The errors included over-reading or false positives (films declared to demonstrate pathology by some readers and found negative by a majority) as well as under-reading or misses (declared positive by a majority and negative by some readers). In addition there was marked variation in interpretation of the films by the various readers (inter-individual variation) and by the same reader on different occasions (intra-individual variation).

From these studies it is concluded that the degree of error in mass roentgen surveys may be reduced by (1) careful selection of the readers; (2) use of valid tests for readers prior to appointment; (3) use of dual readings; (4) expert supervision of film quality; and (5) avoidance of reader fatigue and eye strain. (See also abstract in this Journal, Feb., 1950, *63*, 283–284.)—*Gerald Lavner, M.D.*

Boucot, Katharine R. Mass surveys as case-finding techniques for pulmonary neoplasms. *Am. Rev. Tuberc.*, Nov., 1950, *62*, 501–511.

In view of the low mortality of pneumonectomy and of the hopeless prognosis of untreated carcinoma of the lung, the value of early detection of these lesions and the possibility of their detection in mass surveys is emphasized. The author states that a review of Philadelphia Tuberculosis and Health Association surveys obtained between May 1, 1945, and March 31, 1948, and totalling 156,920 individuals, revealed 34 proved malignant tumors, an incidence of 1 in 5,000. In individuals with symptoms (26,209 cases), the incidence was 1 in 2,000.

The author further states that her group reads as "suspect neoplasm" all photofluorograms in which there is present a parenchymal mass, emphysema suggesting obstruction, mediastinal enlargement, atelectasis, soft infiltration, or cavity associated with mediastinal involvement. Typical case histories are presented.—*Hugh Caumartin, M.D.*

Overholt, Richard H. Cancer detected in surveys. *Am. Rev. Tuberc.*, Nov., 1950, *62*, 491–500.

Since the value of screening for asymptomatic tuberculosis is established, there is also a real opportunity to find lung cancer in its silent stage as a by-product of these surveys. Differentiation between the two diseases is often difficult and sometimes impossible. The author emphasizes the importance of acceleration of the follow-up program in order to save valuable time in the event the survey film has revealed evidence of possible lung cancer.

The incidence of possible tumors detected by chest roentgenograms averages in several reported surveys, 0.8 per 1,000 persons examined.—*Hugh Caumartin, M.D.*

Griffith, Eugene R., McDonald, John R., and Clagett, O. Theron. Alveolar-cell tumors of the lung. *J. Thoracic Surg.*, Dec., 1950, *20*, 949–960.

This is a report of 7 cases of alveolar cell tumors of the lung. These cases have been added to the 51 cases reported in the literature and a statistical survey of the combined groups made.

The histogenesis suggests that these tumors are epithelial in origin. Although alveolar cell tumors have been reported as nodular and diffuse, both forms appear to be the same. From the gross appearance of the lesions it seems likely that the nodular form is primary and that the nodules later coalesce to form a diffuse tumor. Multicentricity of the tumor was present in all 7 reported cases. The total survey group had bilateral involvement in 69 per cent.

Symptomatology offers little of diagnostic significance, the chief complaints being cough and dyspnea. Cytologic examination of the sputum and bronchial washings gives the only positive preoperative diagnostic aid. Roentgenograms of alveolar cell tumors may simulate both inflammatory and

neoplastic disease of the lung. There are no characteristic roentgen findings.

Surgical resection of the affected pulmonary region offers the only treatment of value at present. Although these tumors are often multicentric the authors believe that operation should not be withheld, even if it is only for palliation.—*T. C. Stansbury, Jr., M.D.*

Davis, Martin W., and Simon, Thomas R. Alveolar cell tumor of the lung. *Am. Rev. Tuberc.*, Dec., 1950, *62*, 594–609.

Five cases of so-called alveolar cell tumor of the lung are presented and the clinical, roentgenologic and pathologic features are discussed.

Only 1 patient, aged fifty-seven, was less than seventy years old. The principal symptoms were dyspnea, chest pain, weight loss, and cough with expectoration of foamy or mucoid material. The signs included cyanosis and low grade fever. The average duration of life from the onset of symptoms was fifteen months, and deaths were apparently due to respiratory failure. Metastases occurred in only 1 case (to the pleura).

The disease appears to be multicentric in origin, and the possibility of a virus etiology has been considered.

Roentgenograms gave positive findings in all cases. Diffuse infiltrations of a mottled, nodular or conglomerate nature were present bilaterally in all but 1 instance, in which the process appeared unilateral. Tuberculosis and primary atypical pneumonia were the diagnoses most commonly suggested although metastatic carcinoma, Boeck's sarcoid, pulmonary fibrosis and pneumoconiosis also entered into the differential diagnosis.

At present the only method of exact diagnosis is by thoracotomy and removal of a biopsy specimen. Cytologic study of the sputum may be of assistance. There is no known therapy.—*Hugh Caumartin, M.D.*

Singleton, A. C. The radiologist's responsibility in bronchogenic cancer. *J. Canad. A. Radiologists*, Dec., 1950, *1*, 59–68.

The rising incidence of cancer of the lung as a cause of death and the advanced stage at which many cases are diagnosed present a serious challenge to the medical profession. The radiologist, in particular, is in the best position to make an early diagnosis, and he must cultivate a high index of suspicion. Recurring bouts of pneumonia in the same portion of the lung or apparent pneumonia which is unusually slow to resolve should always raise the question of malignancy. The confusion of bronchogenic carcinoma with tuberculosis or the co-existence of the two must not be overlooked.

Since the classical signs of a mass in the lung, gross atelectasis, enlarged paratracheal lymph nodes, pleural effusion, usually indicate advanced disease, the radiologist must be alert to the earlier signs such as lesser degrees of atelectasis as evidenced by a change in the appearance and position of the hilar shadows, change in the arrangement of the vascular shadows in the periphery of the lung, and change in position and contour of the interlobar septa. It is important to emphasize that even major degrees of atelectasis may present only these secondary signs if the surrounding lung by over-expansion compensates for the diminished volume of the collapsed area.

In suspicious cases further investigations by laminagraphy and bronchography are important. Laminagraphy may reveal unsuspected cavitation, irregular bronchial filling defects characteristic of carcinoma, complete bronchial occlusion, or enlarged paratracheal lymph nodes, when such findings are not obvious on the routine films. It may also demonstrate that a lesion which appears to have a hazy outline in plain films due to overlying air-containing lung is actually a homogeneous mass with relatively sharp borders.

Bronchography must be properly performed to be of greatest value. Every bronchus of every lobe should be outlined and only one side should be done at one time. This method of examination is particularly useful in demonstrating occlusion of the smaller bronchi which are not visible through the bronchoscope.

Illustrative cases are reported.—*L. K. Sycamore, M.D.*

Bugden, Walter F. Asymptomatic and circumscribed lesions of the chest. *Am. Rev. Tuberc.*, Nov., 1950, *62*, 512–517.

It is most interesting to speculate on the nature of "round" or "circumscribed" lesions of the chest, but one must recognize that only the pathologist can establish the actual diagnosis after resection, excision or biopsy. The author states that more than half of these lesions are ultimately shown to be malignant. The prime duty of the physician is to say to the patient: "There is a roentgenographic shadow that should not be present. The exact nature of it cannot be established without operation. I strongly urge you to have it removed at operation because of the possibility of malignancy."

Eight demonstrative case histories are presented. —*Hugh Caumartin, M.D.*

Moritz, Alan R. The pathologist's approach to pulmonary neoplasms. *Radiology*, Nov., 1950, *55*, 712–715.

The preponderance of evidence is that carcinoma of the lungs is increasing in frequency. Lund found at the Pennsylvania Hospital that during the last fifty years pulmonary cancer had moved from twenty-third to third place among malignant tumors. Jonassen at the University Hospital in Cleve-

land found the disease more prevalent in men than in women, in a ratio of 8 to 1. He also found that only 6 per cent of the patients with pulmonary cancer were Negroes.

Primary carcinoma of the lungs falls into six categories, as follows:

Squamous cell carcinoma (37 per cent): usually arises in a primary bronchus with symptoms and signs of obstruction. The lesion is rarely sharply defined on the roentgenogram. These tumors often attain massive size before metastasizing. Metastasis to the brain is frequent, followed by spread to the cervical lymph nodes, adrenals, liver and spleen.

Adenocarcinoma (18 per cent): Usually arises in secondary or tertiary bronchi and in about 50 per cent of the cases is peripheral in location. Bronchial obstruction usually occurs late. It is frequently manifested as a rounded mass and metastasizes to the tracheobronchial and cervical lymph nodes, the liver, adrenals and spleen.

Small cell carcinoma (23 per cent): Usually arises in a main stem bronchus, with the tracheobronchial and mediastinal lymph nodes showing early and massive involvement.

Carcinoma suriplex (18 per cent): This tumor may mimic squamous cell carcinoma or adenocarcinoma in age incidence, location, roentgenologic appearance, growth characteristics, and metastases.

Bronchial adenoma (3 per cent): This is a tumor of young persons, usually developing in a large bronchus. It leads to early obstruction. Local invasion is the rule.

Alveolar cell carcinoma (1 per cent): In its simplest form this tumor is invasive only in the sense that its cylindrical cells invade the alveolar spaces and line them without apparent destruction of existing pulmonary tissue. The tumors are usually accompanied by pneumonia. So long as the tumor is nondestructive and non-metastasizing, the term pulmonary adenomatosis is appropriate. This process may be circumscribed, may be in multiple discrete centers, and may be unilateral or bilateral.

The author feels that cytological study of bronchial washings will probably prove to be more effective than either roentgenologic examination or the examination of bronchial biopsies in establishing identity of an early bronchogenic carcinoma.—*E. M. Cooper, M.D.*

Culver, Gordon J., Concannon, Joseph P., and MacManus, Joseph E. Pulmonary tuberculomas; pathogenesis, diagnosis, and management. *J. Thoracic Surg.*, Nov., 1950, *20*, 798–822.

The authors believe the term tuberculoma should be restricted to the tuberculous granuloma having a diameter of at least 2 cm. They believe tuberculomas may arise in several ways: (1) encapsulation of a primary giant focus; (2) from encapsulation of a restricted reinfection focus; (3) by complete blockage of a tuberculous cavity.

The accurate differential diagnosis of a solitary circumscribed mass in the lung is extremely difficult or impossible, and in a large number of cases an exploratory thoracotomy will be necessary to establish the correct diagnosis.

The authors classify tuberculomas roentgenologically into two general groups:

1. Tuberculomas without calcification.
2. Tuberculomas with calcification.

Tuberculomas without calcification or with areas of breakdown in calcified or non-calcified lesions should be removed surgically for two reasons: (1) the imminent danger of spread to the surrounding lung; (2) it has been well established that if no calcification or cavitation is demonstrated over 50 per cent of the solitary circumscribed pulmonary masses are malignant.

It is probably safe to advise conservative, well managed observation in patients with definitely calcified solitary lesions without any evident breakdown. The authors state that calcification does not occur in primary pulmonary malignancies.—*T. C. Stansbury, Jr., M.D.*

King, J. Cash, and Carroll, David S. Pulmonary adenomatosis; a report of four cases. *Radiology*, Nov., 1950, *55*, 669–680.

First reported by Boone in 1939, pulmonary adenomatosis is being diagnosed more and more frequently. It is characterized by a remarkable proliferation of alveolar lining cells throughout large areas of the lung, by an absence of invasive characteristics, and by an absence of regional or distant metastases. Present status of the disease is discussed and 4 case reports are given.

Increasing dyspnea is the most constant feature of the disease. This can be readily explained by a remarkable hyperplasia of the epithelium in the alveoli and the accumulation of mucoid material in the bronchi. Cough is a constant and striking feature. It is productive of varying amounts of sputum, up to 40–50 ounces in a twenty-four hour period. Hemoptysis is uncommon except in the late stage. Loss of weight is pronounced, accompanied by anorexia and weakness. The disease runs an afebrile, gradually retrogressive course, with fatal termination in from a few months to two or three years due to asphyxia and terminal pneumonia.

Two types of roentgen pattern are encountered. In the first type the areas involved show numerous nodular densities. These nodules cast relatively soft, poorly delineated shadows which fade into the normal lung tissue. They vary in size from 2 mm. to 1 cm. in diameter. In areas of greater involvement the nodules may appear to be confluent. The other pattern is a homogeneous density resembling areas of pneumonic consolidation. Serial films over a period of weeks show little change. Absence of hilar or medi-

astinal adenopathy is characteristic. In general, the areas of greatest involvement are in the central lung zones and in the bases.

Similarity of pulmonary adenomatosis and alveolar cell carcinoma is discussed and the conclusion is reached that pulmonary adenomatosis, although usually a benign alveolar-cell tumor, is at least precancerous.

Bronchoscopy and aspiration biopsy of the lung are advocated diagnostic aids. Treatment is symptomatic, with lobectomy probably indicated if the disease is localized to one lobe. The lesion does not seem to be radiosensitive. Roentgen therapy has yielded disappointing results in several cases.—*A. W. Sommer, M.D.*

Paul, Lester W., and Juhl, John H. Pulmonary adenomatosis; further roentgen observations. *Radiology*, Nov., 1950, *55*, 681–691.

Four additional cases of pulmonary adenomatosis are reported, but the main features of this article are the comments in regard to the pathologic and clinical findings.

Pulmonary adenomatosis occurs with about equal frequency in males and females, in contrast to the high incidence of males in carcinoma of the lung. Cough and dyspnea are the two most prominent symptoms and there may be unusually large amounts of mucoid sputum. Gross hemorrhage is rare. The dyspnea is frequently extreme in the late stages of the disease.

The roentgen diagnosis is not possible on any one examination but serial studies may lead one to suspect the disease. Commonly the findings appear as a patch of pneumonic consolidation. There is no enlargement of the hilar lymph nodes and no pleural reaction. Cavitation and bronchiectasis are not common. If the diagnosis is made early and a lobe or lung removed, the disease invariably appears in other pulmonary areas within a short time. These new areas may coalesce and apparently consolidate practically all of the lung.

One must conclude that even in early cases there are multiple foci of insufficient size to be detected roentgenographically. A less common form of the disease is that in which there are multiple, poorly defined nodules scattered throughout the lungs.

If the patient has roentgen evidence of a pneumonic process which slowly progresses over a period of months and if there is a cough and excessive mucoid sputum, the diagnosis of pulmonary adenomatosis should be considered. Cytologic study of the sputum may give the proper diagnosis.

There is considerable disagreement in regard to the place of pulmonary adenomatosis in the classification of neoplasms. The authors believe that this is a tumor which may have wide variations from a benign growth with no evidence of spread or metastasis to a frank carcinoma without metastasis and a final form similar to if not identical to alveolar cell carcinoma.

There is no curative treatment, and roentgen therapy or surgical removal offers little palliation.—*C. A. Stevenson, M.D.*

Hoppe, H. J., and Diethelm, Lothar. Über angeborene Lungencysten. (Congenital cysts of the lung.) *Chirurg*, Sept., 1950, *21*, 517–520.

Two cases of surgically treated bronchial cysts are reported. Both of them were solitary and symptomless in an eight and nine year old boy. The danger of these cysts is their infection at which time surgical removal becomes much more difficult and risky. They should be removed either by extirpation or, if necessary, by lobectomy or pneumonectomy.—*H. W. Hefke, M.D.*

Leggat, Peter O. Cardiological case finding by means of mass miniature radiography. *Brit. M. J.*, Dec. 16, 1950, *2*, 1364–1366.

The author made a follow-up study of cases having a cardiac abnormality detected in a mass survey of 12,173 persons. All cases suspected as being abnormal from the miniature film study were recalled for a routine history and physical examination which was followed by large film studies and a barium swallow if necessary.

The criteria used for diagnosing cardiac abnormalities included: enlargement of the cardiac shadow, undue prominence of the pulmonary artery, change in contour of the aortic arch and cardiac shadow, and change in the lung fields.

Some of the difficulties encountered in diagnosing cardiac abnormalities were: adiposity causes broadening of the heart shadow; in young adults the pulmonary artery may be prominent normally; tortuosity of the aorta may be difficult to estimate; and secondary radiation produces blurring of the cardiac shadow in obese persons.

Cardiac disease was found roentgenologically and checked clinically in 47 cases of the 12,173 subjects. The majority of cases were of the rheumatic heart disease type. Hypertensive heart disease was the next most common, followed by congenital heart disease.

The author concludes that mass miniature roentgenography is of value in identifying some cases of cardiac disease, though in a survey a large number will be missed due to technical reasons and the lack of sufficient change to be detected roentgenologically.—*C. W. Cooley, M.D.*

Akman, L. C., Miller, A. J., Silber, E. N., Schack, J. A., and Katz, L. N. The ventricular electrokymogram. *Circulation*, Dec., 1950, *2*, 890–899.

The paper consists of a study of over 200 left ventricular electrokymographic tracings obtained in

32 normal adults, averaging more than six sites per individual.

Method. The electrokymograph is a device by which graphic registrations of the movements of the heart and great vessel borders may be obtained. It consists essentially of a pick-up unit, which is mounted on a fluoroscopic screen, and a recording galvanometer. The pick-up unit contains a highly sensitive phototube and a narrow strip of fluorescent screen. The phototube converts light energy from the excited strip of fluorescent screen into electrical energy, the current thus produced being recorded by the galvanometer of an electrocardiograph. The excitation of the pick-up device is proportional to the amount of roentgen-ray transmission, the latter depending on the area, thickness, and density of the tissue interposed between the roentgen tube and the slit of the pick-up. Connections are so arranged that an increase in roentgen-ray transmission to the pick-up device causes a downward movement of the galvanometer string, and a decrease in roentgen-ray transmission causes an upward movement of the string.

In this study the heart sounds were recorded simultaneously with the electrokymographic tracings. Tracings were taken in mid inspiration with subjects in the upright position at various points on the silhouette of the left ventricle, employing both the posteroanterior and left anterior oblique positions.

Results. Measurements of the various phases of the electrokymogram revealed significant differences between sites in the same heart as well as between different individuals. There appeared to be no consistent moment-to-moment time relationship between electrokymograms and the heart sounds. The tracings revealed a basic resemblance in contour but with numerous variations. Individual variations in the normal tracings appeared identical with those interpreted by other authors as aortic insufficiency, myocardial infarction, and constrictive pericarditis.

The authors conclude that the relationship of various points on the electrokymogram to the phases of the heart cycle is variable and that there is considerable variability in the contour of normal tracings. Caution must be used, therefore, in the interpretation of electrokymograms both as to contour and their depiction of the phases of the heart cycle.—*L. K. Sycamore, M.D.*

Salans, A. H., Schack, J. A., and Katz, L. N. Correlation of simultaneously recorded electrokymograms and pressure pulses of human heart and great vessels; preliminary report. *Circulation*, Dec., 1950, *2*, 900–906.

Concurrent right heart catheterization and electrokymography were performed with simultaneous recording of intraluminal or intracavitary pressure, the electrokymogram, direct brachial arterial pressure, and lead II of the electrocardiogram. Readings were corrected for time lag in the apparatus. Studies were made on a child of five years with a diagnosis of tetralogy of Fallot, a sixty-eight year old man with arteriosclerotic heart disease and chronic cor pulmonale, and 4 children from eight to fifteen years of age considered to be normal.

Study of the tracings indicated that the electrokymographic deflections obtained from the superior vena cava and the pulmonary artery showed a remarkable constancy of time relationship with simultaneous intraluminal pressure curves. Densograms obtained over these areas showed a somewhat greater variation. It was concluded that these electrokymograms reflected closely the mechanical activity of the heart as it was propagated to the adjacent major vessels. The ventricular electrokymogram was found more difficult to define. It was concluded that the declining limb of the ventricular electrokymogram represented more than the systolic emptying of the ventricle, and it was impossible to evaluate the respective contribution of isometric contraction, rotation of the heart, isometric relaxation, and other factors. The final conclusion was a warning that until more complete definition of the physiologic meaning of these tracings could be obtained, clinical applications must be approached with great caution.—*L. K. Sycamore, M.D.*

Böhme, W. Kymographische und röntgenkinematographische Untersuchungen der Herzfunktion. (Kymographic and roentgen cinematographic investigations of cardiac function.) *Röntgen-Blätter*, Nov., 1950, *3*, 288–300, and Jan., 1951, *4*, 12–21.

Böhme has for many years been interested in the study of cardiac physiology as revealed by roentgenologic methods. The special problems of cardiac action which he has studied by means of fluoroscopy, kymography, and roentgen cinematography are: (1) mechanism of return flow of blood to the heart, i.e., venous return; (2) position changes in the inner cavity of the heart during its action; (3) the "valve-level" movements in relation to cardiac filling and ejection; and (4) blood movement in the heart and in the central veins and arteries.

Two special methods of study which he employed are the "contrast blood" and the "swimming mark." By "contrast blood" the entire circulatory system of animals is visualized by saturation of the blood with colloidal thorotrast; the heart and vessels are then visible on fluoroscopy and films. The "swimming mark" is for the demonstration of the movement forms of blood in the central vessels and in the cardiac cavity by the use of slowly infused drops of iodized oil. Both methods were first employed by the author in conjunction with flat roentgen kymography; later roentgen cinematography was added.

For roentgen cinematography in humans Böhme, before World War II, used ordinary diagnostic roent-

genographic machines and normal motion picture cameras and produced films at the rate of 64–80 frames per second. Later with a small slow motion model from the Askaniawerke, 200 frames per second with a total exposure time of one second were obtained on several occasions. By measurement of the enlarged film strip and therein recorded movements of a "swimming mark," a quantitative curve analysis of blood flow, time, and direction could be charted.

Conclusions drawn from these research methods applied to animals and humans are briefly:

(1) The ventricular heart advances the blood in the manner of a membranous pump which at the same moment sucks and empties. The piston of such a pump is represented by the valve-level (a tissue plate into which the four valves are engaged and upon which the ventricular and auricular musculature are added). This valve level movement can be studied satisfactorily by fluoroscopy and kymography of patients with a calcified annulus fibrosus.

(2) The classical mechanisms of venous return to the heart, i.e., gravity, vis a tergo, muscular contractions, diaphragmatic movement, negative intrathoracic pressure, etc., are secondary to the "membrane pump."

(3) The part of the heart with the greatest range of excursion is the valve-level and not the cardiac apex.

(4) The auricles are not rudimentary structures. Filling of the ventricular heart is from the auricles during the first third of ventricular diastole. Blood from the great veins then flows into the atria synchronously with ventricular systole; during ventricular diastole there is usually no forward movement of blood in the upper great veins. There is thus a "transfusion" between atria and ventricles in the first third of ventricular diastole. The atrial systole plays no active role because it occurs at the end of ventricular diastole when the ventricle is already filled.

(5) By demonstration of blood movement in the aorta and pulmonary artery it is seen that the forward movement of arterial blood is analogous to the movement of the venous return flow. That is, there is after each systolic forward movement a short post-systolic stop—a double pendulum motion.

Other less important theories and observations are recorded in this excellent review article.—*Harold Fulton, M.D.*

Bayliss, R. I. S., Etheridge, M. J., and Hyman, A. L. Pulmonary hypertension in mitral stenosis. *Lancet*, Dec. 30, 1950, *2*, 889–894.

Breathlessness on exertion, paroxysmal dyspnea, hemoptysis, accentuation of the pulmonary second sound, increased prominence of the pulmonary vascular shadow, dilatation of the pulmonary artery, enlargement of the right ventricle, and electrocardiographic changes have been accepted as indicating increased pressure in the lesser circulation. Cardiac catheterization has made direct measurement of the pressure in the pulmonary artery and right ventricle a reality.

In order to determine how far the clinical symptoms and signs are a reliable guide to the extent of pulmonary hypertension, the authors measured the right ventricular and/or pulmonary artery pressures on 22 patients with mitral stenosis. They found pulmonary hypertension at rest in 17 patients. Those with the most severe symptoms had the highest pressures, but the duration of symptoms was not related to the degree of pulmonary hypertension.

Patients with severe lesser circulation hypertension without peripheral venous congestion manifest predominant pulmonary symptoms and electrocardiographic evidence of right ventricular hypertrophy. Patients with lesser degrees of pulmonary hypertension did not present characteristic features. Right ventricular enlargement, however, was found in all patients with pulmonary hypertension. There was no relation between the size of the left antrum and the degree of pulmonary hypertension.

On exercise a striking rise in pulmonary artery pressure occurred without a significant increase in the cardiac output. The authors present evidence to support their contention that these findings were due to increased pulmonary arteriole resistance as well as stenosis of the mitral valve.—*W. C. MacCarty, Jr., M.D.*

Young, Dennison, and Schwedel, John B., Calcification of the left atrium in rheumatic heart disease. *Am. Heart J.*, Nov., 1950, *40*, 771–778.

Four cases of left atrial calcification are described. All of the patients exhibited the typical clinical symptoms and signs of advanced rheumatic heart disease with mitral stenosis.

By oblique chest roentgenogram (preferably an over-exposed film) the calcified wall of the enlarged left atrium can be identified. The calcium in one autopsied case proved to lie in the subendothelial region of the atrial wall. Differentiation from pericardial and intracardiac calcification concerns the following features of atrial wall calcification: (1) the identification of prominent left atrial and right ventricular enlargement in a patient with mitral valvular deformity of long standing; (2) the presence of calcification in the area of the left atrium, especially in the right anterior oblique view, anterior to the barium-filled esophagus, and in the left anterior oblique view where upward enlargement of the left atrium approaches, displaces, or compresses the left main bronchus; (3) the absence of calcified areas elsewhere within the heart shadow that might suggest a more diffuse distribution of calcareous deposition with just a fortuitous concentration in the region of the left atrium.

Reproductions of excellent roentgenograms demonstrate clearly the diagnostic features in the cases discussed.—*Harold Fulton, M.D.*

Adams, Forrest H., La Bree, John W., Jorgens, Joseph, and Veasy, L. George. Right heart catheterization of anomalous pulmonary veins emptying into the right atrium. *Radiology*, Dec., 1950, *55*, 834–838.

The authors present the case histories and accompanying roentgenograms of 3 patients having an anomalous insertion of one or more pulmonary veins into the right atrium. This occurred in 3 patients clinically suspected of having an interatrial septal defect.

In these patients, it was difficult to ascertain the presence or absence of an interatrial septal defect from the oxygen content values of the blood in the various chambers. Although some cardiologists feel that anomalies of the veins are of little significance, it is important to know whether the anomalous insertion is complicated by other intracardiac defects. If the only abnormality is the anomalous pulmonary vein, it could be ligated surgically. Thus, the increased load placed on the right side of the heart could be removed.—*E. M. Cooper, M.D.*

Oliva, Luigi. Lo studio stratigrafico assiale trasverso dell'aorta toracica patologica. (Axial transverse stratigraphy in the study of pathology of the thoracic aorta.) *Radiologia*, Roma, Nov.-Dec., 1950, *6*, 649–665.

The diagnosis of disease of the thoracic aorta by conventional roentgenography is difficult since the entire course of the aorta is not clearly shown nor are the mediastinal structures separated from one another. Because of this superimposition of shadows, mediastinal pathology is often undetectable or when visible often cannot be differentiated. Conventional laminagraphy only partially overcomes these difficulties.

Axial transverse laminagraphy, done in planes perpendicular to the long axis of the body, has two advantages: (1) it permits a three-dimensional evaluation of organs having varied spatial relationships such as those of the mediastinum when used in combination with conventional laminagraphy; (2) it largely eliminates the confusing shadows produced by objects lying in planes proximal or distal to the stratum being roentgenographed and produces clearly outlined images in the plane under study.

By this method, the margins of the ascending aorta, aortic arch and the descending aorta are more sharply outlined and the caliber of the aorta can be determined at various levels. When an opacity is present to the right or to the left or to both sides of the cardiovascular shadow, differentiation between simple aortic dilatation, aortic aneurysm and mediastinal or pulmonary neoplasm is difficult if not impossible with conventional methods, whereas axial transverse laminagraphy permits a more exact determination of the site, configuration and origin of the lesion.

The author presents the following 5 cases which illustrate the diagnostic value of the method: (1) a saccular aneurysm at the junction of the ascending and middle thirds of the arch; (2) a luetic aneurysm of the ascending aorta; (3) an extracardiovascular mass in the right superior mediastinum; (4) an aneurysm of the distal arch and adjacent descending aorta; (5) an anomalous right-sided aortic arch and thoracic aorta.—*C. Colangelo, M.D.*

Pierre-Marion, and Papillon, Jean. Aortographie thoracique rétrograde intracarotidienne (application à l'artériographie des coronaires). (Thoracic aortography through the retrograde intracarotid route; application to the arteriography of the coronary arteries.) *Presse méd.*, Dec. 25, 1950, *58*, 1474–1477.

The authors review various methods of investigation of the aorta by means of contrast medium and describe one which they have found to be more reliable, and to delineate that structure more accurately, than others hitherto proposed. Through a small incision in the external carotid, a special trocar is inserted and advanced into the common carotid under fluoroscopic control. The procedure is carried out under general anesthesia in infants and nervous adults, but may be feasible under local anesthesia in young infants. Preliminary sensitivity tests are made. Using a 100 cc. syringe, 50 to 60 cc. of 70 per cent diodrast is injected with sufficient force to overcome the aortic pressure which, in conditions such as coarctation, is often high. After the skin incision has been made and prior to insertion of the trocar, 50 mg. of heparin is injected to avoid accidents due to coagulation. The patient is in position for right posterior oblique projection.

Using this method the authors were able to make a positive diagnosis of aortic aneurysm, where fluoroscopy and intravenous aortography did not permit a differentiation from mediastinal cyst. The paper is illustrated with several examples of coarctation of the aorta. In addition to being valuable for accurate delineation of ductus arteriosus, aortic aneurysm, and coarctation, the method also proved applicable in visualizing the coronary arteries experimentally.

Advantages claimed for this method over others in common use are:

1. There is no obstruction to the carotid stream during the maneuver.

2. Diodrast is injected directly into the aorta, thereby exploring the lesion more accurately.

3. Ease of technique; after removal of the trocar it is easy to ligate the carotid, while it is not always possible to suture an artery in spasm under best aseptic conditions.

4. A small, esthetic, submaxillary incision is all that is necessary, and this is accepted more readily by the patient than a large incision, such as is used to expose the common carotid.—*A. K. Wilson, M.D.*

Dotter, Charles T., Roberts, Douglas J., Jr., and Steinberg, Israel. Aortic length: angiocardiographic measurements. *Circulation*, Dec., 1950, *2*, 915–920.

Angiocardiography makes it possible to study the aortic contour, form, and its length during life. The authors are apparently the first to record studies of the length of the thoracic aorta, as measured during life. Their material includes 250 selected angiocardiograms made in the left anterior oblique or left lateral projections at a 72 inch target-film distance. Four standard measurements were made: of the length of thoracic aorta, length of ascending aorta, length of descending aorta, and caliber of the mid-portion of the ascending aorta. The statistical analysis of the data obtained allowed only a few broad generalizations.

Normal length of the aorta covers a wide range. Advanced age, arteriosclerosis, syphilis and hypertension, produce aortic elongation. Syphilis produces disproportionate elongation and widening of the ascending limb of the aorta.—*R. E. Kinzer, M.D.*

Keith, John D., and Forsyth, Constance. Aortography in infants. *Circulation*, Dec., 1950, *2*, 907–914.

The necessity for early diagnosis of congenital heart disease was brought to the attention of the authors when an infant of two months was admitted to the hospital with cardiac failure. Patent ductus arteriosus was suspected and proved by aortography. Their method of using the left brachial artery to inject diodrast up into the aorta is described. The illustrations are very good and in the cases in which the dye was injected rapidly enough the entire aortic arch is outlined. The aortogram showed filling of the pulmonary artery from the aorta in all 8 infants in whom they were able to substantiate the diagnosis of a patent ductus.

This type of examination is also satisfactory for study of coarctation of the aorta. The authors mention 4 of their cases of coarctation and illustrate 1 case.—*R. E. Kinzer, M.D.*

Scholl, Paul. Diagnose einer rechtsseitigen Zwerchfellaplasie durch röntgenologische Untersuchungsmethoden. (Diagnosis of a right-sided diaphragmatic aplasia by roentgenologic methods.) *Röntgen-Blätter*, Nov., 1950, *3*, 300–303.

Following Gruber's classification, the author divides the mechanism of congenital defects of the diaphragm into two groups: (1) disturbance of the diaphragmatic anlage and mechanism of their closure, and (2) disturbance of tissue distribution and eventration. The first type (Group 1) results from a deficiency of the diaphragmatic anlage which form from plate-like folds of the celomic wall growing forward from the dorsal and ventral aspects of the celomic cavity to join at about the seventh or eighth embryonal week. This growth arrangement predisposes all types of anomalies. Where there is complete lack of the diaphragm on one or both sides, the complete absence of the anlage should be considered; diaphragmatic hiatases and false hernias result from a retardation of closure of the various leaves.

The symptoms of congenital anomalies of the diaphragm are often misleading; the correct diagnosis can be made, however, by careful roentgenologic examination. The author's illustrative case is that of a seven year old girl who was referred for roentgen study with the clinical diagnosis of right-sided pleural thickening or effusion. Fluoroscopy with barium swallow and films revealed a complete absence of the right diaphragm, the right thorax accommodating the major portion of the large bowel, the liver, and the gallbladder. The thoracic spine contained several deformed vertebrae—a frequent finding in association with diaphragmatic malformations.—*Harold Fulton, M.D.*

Samson, Paul C., and Childress, Max E. Primary neurofibrosarcoma of the diaphragm; report of two cases. *J. Thoracic Surg.*, Dec., 1950, *20*, 901–910.

This is a report of 2 cases of primary neurofibrosarcoma of the diaphragm. These are the first tumors of this particular cell type found in the literature, making a total of 35 reported cases of primary tumor of the diaphragm. Seventeen of these were benign and 18 were malignant. A brief review of the previously reported cases and the results of 14 operated cases is given.

The signs and symptoms of tumor of the diaphragm are governed by the size and location of the tumor. As a rule, they do not appear until the lesion has reached considerable size. Pressure atelectasis frequently occurs. Bronchographic mapping may reveal distortion of the tracheobronchial tree. If distortion is present and there is no endobronchial pathology, an extrapulmonary tumor is suggested. Pneumoperitoneum may be used to differentiate the tumor from an infradiaphragmatic mass. Pneumothorax is often of little value in diagnosis.

The authors believe exploratory thoracotomy should be undertaken for diagnosis and treatment unless the operative risk is prohibitive.—*T. C. Stansbury, Jr., M.D.*

Bickerstaff, Hugh J., Comstock, George W., and Burke, Mary H. Routine antenatal chest x-ray findings in patients drawn from a

currently surveyed population., *Am. J. Obst. & Gynec.*, Jan., 1951, *61*, 41–49.

The present report is a study of 3,576 prenatal patients routinely microfilmed from August 1, 1946, through July 31, 1949, including 100 per cent of the clinic patients and 29 per cent of the private patients.

In Muscogee County, Georgia, a tuberculosis survey has been made among the entire population since 1946. Seventy per cent of women of childbearing age were included in the initial survey and, in the last three years, 85 per cent of these had photofluorograms of the chest.

Four per cent of prenatal cases gave evidence of a chest lesion requiring diagnostic study; 1.2 per cent had pulmonary tuberculosis (43 positive diagnoses in 37 patients). The prevalence of tuberculosis was slightly higher in white than in Negro gravidas. Of 85 patients recalled for possible intrathoracic lesions other than tuberculosis, only 55 were followed adequately and these showed 25 normal, 25 with cardiovascular lesions and 5 with non-tuberculous but significant chest lesions.

The effectiveness of the screening system was tested by comparison to the probable number of tuberculous cases among all pregnant women in the county. As against a probable number of 50 cases, 37 individual cases were found, or 74 per cent of the estimated tuberculous gravidas. Of the 37 individuals diagnosed tuberculous, 28 had been previously diagnosed and 9 were new cases, and of these latter, only 3 were active; 3 of the older cases were also found to be reactivated.

The community survey after childbirth discovered 5 tuberculosis cases interpreted as negative on the antepartum survey and 5 that had not been referred for microfilms during pregnancy. Of these, 50 per cent probably and 50 per cent possibly had disease during pregnancy.

The outlook for mothers and children is definitely more disastrous in the group discovered postpartum than in the prenatally diagnosed group.

The authors conclude that a single film in early to mid-pregnancy is insufficient to assume that no clinically important disease may develop. They suggest a supplementary examination at the initial post-partum visit.

Since tuberculosis is often exacerbated by pregnancy, more careful checks of known tuberculous patients are indicated, both antepartum and postpartum.—*Martha E. Mottram, M.D.*

Knoll, V. Postoperative Lungenverschattungen. (Postoperative pulmonary shadows.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Oct., 1950, *73*, 537–546.

The pathogenesis of atelectasis is re-examined and the diagnosis of pneumonia as the most frequent postoperative complication is questioned. According to the "mechanical" theory, atelectasis is caused by a mucous plug in the bronchus. The air distal to the obstruction is absorbed, thus providing conditions suitable for the development of pneumonia. The latter diagnosis is suggested by the fever which accompanies these reactions. Because of the obstruction, bronchoscopic suction is advised.

The author prefers the "reflex" theory and calls the condition "contraction atelectasis" for these reasons:

1. If a mucous plug occludes a bronchus, the hypothetical plug should be sucked farther into the bronchus as the resorption of the air distal to the obstruction creates a low pressure area. The "mechanical" theory explains neither the sudden appearance nor the spontaneous resolution of atelectasis. Many cases subside without any therapy.

2. Alterations occur in the circulatory system not only after prolonged anesthesia and extensive surgery but also after severe trauma and respiration is impaired primarily because of interference with proper action of the diaphragm. At autopsy extensive vascular dilatation is noted rather than closure or diminution in caliber of the bronchi. Similar changes are seen in poliomyelitis if paralysis of the diaphragm and intercostal musculature occurs.

3. The horizontal arrangement of the linear or platelike atelectatic areas does not conform to the anatomical distribution of the bronchi. This is particularly emphasized in those instances where the linear densities cross the bronchi at right angles. The pattern is quite different in "obstructive" atelectasis:

(a) In bronchogenic carcinoma or hilar adenopathy with bronchial occlusion, segmental atelectasis is probably due to absorption since it develops slowly and produces conical, rounded or triangular shadows conforming to the anatomical relationships of the bronchi.

(b) Residuals of infarctions characterized by linear densities are arranged in various patterns but usually in a radial fashion similar to the course of pulmonary vessels and bronchi.

4. In none of the 6 cases presented by the author was there any evidence of pneumonia. However, because of the fever, antibiotics were routinely given. This may have accounted for the negative sputum cultures.—*Joseph Zausner, M.D.*

Woods, James W., Manning, Isaac H., and Patterson, Carl N. Monilial infections complicating the therapeutic use of antibiotics. *J.A.M.A.*, Jan. 27, 1951, *145*, 207–211.

Twenty-five cases of clinical moniliasis following the therapeutic use of penicillin, aureomycin and chloramyphenicol are reported. In 2 of these patients the lungs were involved and the chest roentgenograms were said to show a patchy pneumonitis.

In vitro studies of four strains of *Candida* show

that these antibiotics have no stimulating or suppressing effect on the rate of growth.

Suppression of bacterial flora coexisting with *Candida* and competing for nutrition in the same substrate is thought by the authors to be the most probable cause for monilial overgrowth and host infection.

Treatment with vitamin B complex seems to have some value.—*J. J. McCort, M.D.*

Michael, Max, Jr., Cole, Roger M., Beeson, Paul B., and Olson, Byron J. Sarcoidosis; preliminary report on a study of 350 cases with special reference to epidemiology. *Am. Rev. Tuberc.*, Oct., 1950, *62*, 403–407.

During World War II, 350 cases of sarcoidosis were observed in military personnel. Preliminary observations obtained from an analysis of the Veterans Administration records of these patients are presented. To date, the study has revealed a geographic predominance for the southeastern United States and for a rural distribution of birthplaces. This is true for both white persons and Negroes. In addition, it appears that the reported high incidence of negative tuberculin skin tests may be related to the distribution of the disease. It was found that a positive skin reaction was obtained in 26 (46 per cent) of 56 patients from urban centers but in only 25 (23 per cent) of 107 patients from rural areas.—*H. T. Caumartin, M.D.*

Kritzer, Morton D., Biddle, Marjorie, and Kessel, John F. An outbreak of primary pulmonary coccidioidomycosis in Los Angeles County, California. *Ann. Int. Med.*, Oct., 1950, *33*, 960–990.

The authors describe an outbreak of coccidioidomycosis which occurred in a forestry camp in Los Angeles County, California, and give a comprehensive review of the literature published on primary coccidioidomycosis concerning diagnosis and treatment. Epidemiological studies and 7 case reports are given in detail.—*H. R. Fishback, Jr., M.D.*

Bergstrom, W. H., Cook, C. D., Scannell, J., and Berenberg, W. Situs inversus, bronchiectasis and sinusitis. *Pediatrics*, Oct., 1950, *6*, 573–580.

Kartagener reported 4 cases in 1933 of bronchiectasis, sinusitis and situs inversus occurring concurrently. His name has been given to this syndrome. The authors present a tabular summary of the 80 cases of this syndrome which have been reported up to the present time. It has been previously established that bronchiectasis occurs in 12–23 per cent of cases of transposition of the viscera. This suggests a hereditary tendency in some cases of bronchiectasis.

In support of this hereditary tendency in bronchiectasis the authors present detailed study of a family of 2 adults and 6 children. The father had chronic sinusitis, the mother was well. Two children had bronchiectasis and chronic sinusitis and 2 had Kartagener's syndrome. The 4 children had bronchiectasis of the so-called acquired type with symptoms beginning in early childhood and profuse nasal discharge.

Situs inversus occurs in roughly 1 of every 8,000 persons. Bronchiectasis occurs in 0.3 to 0.5 per cent of the general population but in 12–23 per cent of patients with situs inversus. The predisposition to bronchiectasis was not present in siblings of persons with situs inversus alone but was present in the siblings of 28 persons with Kartagener's syndrome. The authors conclude that such cases of bronchiectasis are the result of antenatal influences. There is not sufficient evidence to indicate whether this congenital abnormality is an actual structural defect, a physiological failure of the respiratory epithelium, or a predisposition to infection.—*R. M. Harvey, M.D.*

Biggs, Alfred D. Primary complex of pulmonary tuberculosis. *Am. J. Dis. Child.*, Oct., 1950, *80*, 566–577.

The author observed 142 children over an eight year period who showed evidence of the ordinary primary complex of tuberculosis, both clinically and roentgenologically. More than half were under observation for a minimum period of five years. In his paper he presents evidence to indicate that for practical clinical purposes the overwhelming majority of these primary tuberculous infections of the lungs in infants and children are entirely asymptomatic. They can be detected only by a combination of skin tests and serial roentgenograms. The latter is the only effective means of observing their progress. There is no demonstrable effect on the child's well-being.

The primary complex begins as a parenchymal lesion, usually multiple, which drains rapidly into the corresponding hilar lymph nodes. Both the peripheral and the central lesions heal slowly, with calcium deposits in the hilus in about 90 per cent of these children. Peripheral calcium deposits or Ghon tubercle formations occur in about 25 per cent of them. Although the primary infection is rapidly brought under control by the body defenses, the tissue changes, as evidenced by roentgen observation, progress for a period measured in years rather than months. During the course of the author's investigation, 3 children with primary infections were encountered who did have clinical symptoms. The pulmonary lesions in each case cast massive shadows in the roentgenogram, and in each case tubercle bacilli were demonstrated by guinea pig inoculation.

Children with the ordinary primary complex need no treatment except removal from the source of the infection. On the other hand, those with massive primary infection should be treated symptomatically.

They should be isolated as long as tubercle bacilli can be recovered from gastric washings.—*R. S. Bromer, M.D.*

Ross, Joseph, and Farber, Jason E. Right-sided spontaneous pneumothorax complicating therapeutic pneumoperitoneum. *Am. Rev. Tuberc.*, Jan., 1951, *63*, 67–75.

Spontaneous pneumothorax complicating pneumoperitoneum may occur with or without loss of air from the abdominal cavity.

This report is concerned only with the latter complication, i.e., spontaneous pneumothorax associated with a simultaneous disappearance of the pneumoperitoneum. The authors add 15 previously unreported cases to the 5 already in the literature. In each of the cases the pneumothorax occurred on the right side. This seems to be related to the displacement of the liver, incident to the use of the pneumoperitoneum, so that small congenital defects of the diaphragm are no longer occluded by the liver. In contrast, the left diaphragm has been unprotected throughout the life-time of the individual, and defects probably could have been detected by symptoms, abnormal roentgenograms, etc., and, accordingly, complications of an attempted therapeutic pneumoperitoneum would be anticipated and the procedure avoided.—*H. T. Caumartin, M.D.*

Ashe, William M., McDonald, John R., and Clagett, O. Theron. Nonspecific pneumonitis of the left upper lobe (simulating the "middle lobe syndrome" and producing an early superior pulmonary sulcus syndrome); report of case. *J. Thoracic Surg.*, Jan., 1951, *21*, 1–6.

This is a report of a case of nonspecific pneumonitis situated in the apex of the left upper lobe. The lesion produced some symptoms characteristic of the superior pulmonary sulcus syndrome. The roentgenograms revealed a dense homogeneous shadow in the left apex, fan-shaped strands of increased density radiating from the hilus to the left apex, and a slight enlargement of the lymph nodes in the left hilus. They were interpreted as probably indicative of a superior pulmonary sulcus tumor.

Thoracotomy and excision of the left upper lobe was done. The pathologic examination of the excised lobe in some ways resembled the picture of the so-called "middle lobe syndrome." There were enlarged firm lymph nodes which encircled the left main bronchus and left upper lobe bronchus. These produced no extrinsic compression of the bronchus, endobronchial stenosis, or bronchiectatic changes. The pathologic changes in the involved parenchyma were those of a nonspecific pneumonitis.

The authors suggest that the term "middle lobe syndrome" does not represent a distinct entity of middle lobe "atelectasis" but that the same pathologic picture may be produced elsewhere in the lungs, without bronchial stenosis and the bronchiectatic changes of obstructive pneumonitis.—*T. C. Stansbury, Jr., M.D.*

Vischer, W. Veränderungen des Lungengewebes nach Bronchographien mit Joduron B. (Changes in the pulmonary tissues following bronchography with ioduron B.) *Schweiz. med. Wchnschr.*, Jan. 20, 1951, *81*, 54–58.

The author studied 6 lungs in animal experiments, 6, 15, 17, 23, 42, and 90 days following bronchography with ioduron B.

No evidence of retention of ioduron B could be demonstrated roentgenographically in any of these cases on later examinations. It was possible, however, to find a residue of the injected substance histopathologically in all cases. These histopathological changes were quite marked in some instances with the formation of giant cells particularly pronounced.

It was found in experiments on rats that the contrast medium, namely the ioduron, disappears quickly. But the carrier, either the cellulose glycolic acid ether or the carboxymethylcellulose remains in the lung indefinitely.

The advantage in the use of ioduron B compared with lipiodol lies in the fact that ioduron B cannot be found on later roentgenograms and therefore does not disturb future roentgenological studies. It must be recognized, however, that the histopathological changes can be as severe as those following the use of lipiodol. The carrier acts primarily as a foreign body with the formation of giant cells. It then leads to leukocytosis and fibrosis. Large portions of the lung may become useless for respiration. The changes are particularly marked when the substance reaches the pleural cavity.

The reaction is not equal in all cases. A certain individual disposition must be present for the formation of severe alterations.

It is advisable to consider the possibility of such changes when contemplating a bronchography.—*H. P. Mueller, M.D.*

Grandmaison, L. Contribution à l'étude des localisations pulmonaires de la maladie de Gaucher. (Contribution to the study of pulmonary localization in Gaucher's disease.) *Presse méd.*, Jan. 24, 1951, *59*, 85–87.

The disease was originally described by Gaucher as primarily affecting the spleen, but through the years it has been proved to be a lesion of the reticuloendothelial system. It is hereditary, and characterized mainly by a splenomegaly which is progressive and sometimes associated with hepatomegaly. In the later stage enlargement of the lymph nodes is often found.

The author has observed 2 cases which occurred in the same family. Roentgenograms of the chest re-

vealed a fine miliary nodulation in both lung fields. Biopsy of a lymph node was done in one of the cases and Gaucher's disease was found. It is assumed that the pulmonary manifestations are part of the syndrome representing involvement of the reticuloendothelial system of the lungs.

He suggests that where Gaucher's disease is suspected, a roentgenogram of the chest as well as a cytologic examination of the sputum be done.—*J.-P. Jean, M.D.*

Abeles, Hans, and Ehrlich, David. Single, circumscribed, intrathoracic densities. *New England J. Med.*, Jan. 18, 1951, *244*, 85–88.

In the course of mass chest roentgen surveys for the discovery of pulmonary tuberculosis, 44 patients with single, circumscribed intrathoracic densities were seen.

In 31 patients, a malignant lesion could not be ruled out after a complete examination and early exploratory thoracotomy was advised. Twenty-one patients underwent exploratory thoracotomy. Seven primary malignant lesions and one metastatic lesion were removed. Ten patients refused the exploratory operation, 6 of them on the advice of family physicians. Five of the 10 patients were subsequently shown to have a definitely malignant lesion.

Thirteen patients were observed by periodic examinations, since the initial work-up suggested a benign lesion. None of the 13 patients gave evidence of a malignant lesion during a follow-up period of at least two years.

The early exploration of every single intrathoracic mass is recommended whenever a malignant lesion cannot be reliably ruled out.—*J. J. McCort, M.D.*

Pohl, R. Universelle Erweichungszustände am Tracheobronchialsystem (Tracheo-Bronchopathia malacica). (Softening of the entire tracheobronchial system [malacic tracheobronchopathy].) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1951, *74*, 40–43.

Localized areas of softening in the trachea are fairly commonly associated with thyroid struma, mediastinal tumors, or deformities and dilatations secondary to chronic indurative processes of a specific or nonspecific etiology. Involvement of the entire tracheobronchial system was found in a sixty-four year old man, who had three episodes of pneumonia in the fifteen years preceding the present examination. The patient had also been treated for a luetic condition.

Studies with iodized oil showed a relatively narrow trachea with segmental dilatations corresponding to the intercartilaginous spaces. The entire bronchial tree also presented alternating areas of stenosis and dilatation. Fluroscopically the oil was seen to descend very slowly down the trachea and larger bronchi. The mixture of oil, air and secretion was in a constant state of agitation, as though in a boiling pot. This was due less to muscular activity than to a loss of the supportive tissues of the respiratory system. Soon after bronchography, dyspnea increased and the patient died three days later in a state of pulmonary insufficiency.

At autopsy, the trachea was broad and flattened. The tracheal rings were partly flat and partly nodular, whereas the intercartilaginous portions were depressed or hollowed out. Diffuse bronchiectasis, chiefly cylindrical and occasionally saccular, was found, especially in the lower lobes. Numerous distorted shrivelled areas and chronic vesicular emphysema were noted in all lobes. Both upper lobes had extensive pleural adhesions.

Various etiological factors have been proposed but the author believes that the malacia was the result of chronic inflammatory disease superimposed on a congenital weakness of the elastic fibers if not the entire mesenchymal apparatus.—*Joseph Zausner, M.D.*

Celius, Alejandro, Pacheco, Carlos R., and del Castillo, Hermilo. Angiocardiographic diagnosis of mediastinal tumors, with special reference to aortic aneurysms. *Radiology*, Jan., 1951, *56*, 31–38.

The preoperative diagnosis of mediastinal tumors is dependent on clinical syndromes, ordinary roentgenograms of the chest and roentgen examination after the heart and great vessels are opacified.

The most important problem is to differentiate neoplasm from aortic aneurysm, and the authors found that angiocardiography was necessary to solve the problem in 33 out of 95 cases. Sixteen of the patients had aortic aneurysms as demonstrated by the opacification studies.

The technique used consists of the introduction of a Nélaton catheter through either jugular vein and inserting the tip, under fluoroscopic control, into the right side of the heart. Forty to 50 cc. of an opaque medium are injected and films exposed at proper intervals. The lateral view is most advantageous for demonstrating the entire thoracic aorta.

The following are findings in case of aortic aneurysm: (1) delay in circulation time when the aneurysm lies proximal to the great arteries, (2) visualization of fusiform or saccular opacified enlargements of the aorta, (3) opaque shadow of approximate double density means that the aneurysm lies axial to the roentgen-ray beam, (4) halo of less density about the opaque swelling indicates that some of the aneurysmal wall contains blood clot.—*C. A. Stevenson, M.D.*

Stout, Arthur Purdy, and Himadi, George M. Solitary (localized) mesothelioma of the pleura. *Ann. Surg.*, Jan., 1951, *133*, 50–64.

The authors review a series of 8 cases of solitary mesothelioma of the pleura.

These tumors are the most common of the rare primary pleural tumors and have been reported under a variety of names.

They are composed of spindle-shaped cells and connective tissue fibers in a unique arrangement which differentiates them from all other fibrous tumors.

They either project outward into the pleural cavity or else extend from the pleura into the lung or chest wall.

In each of the 8 cases, roentgenograms disclosed a single solitary intrathoracic mass.

From the viewpoint of the radiologist these tumors may be divided into three groups: (1) solitary tumors in contact with the chest wall which project into the pleural cavity, (2) tumors lying within an interlobar fissure, (3) tumors which appear to be in the lung parenchyma but actually are attached to the visceral pleura and either project outward from the pleural surface or are embedded within the lung.

In none of the cases was the correct diagnosis included in the differential roentgen diagnosis. This was probably due to their rarity and the fact that their appearance is similar to many more common conditions.

These tumors are circumscribed; some of the benign and malignant forms grow slowly and metastasize sparingly and are very favorable for surgical treatment.

Reproductions of roentgenograms, photographs of gross specimens and photomicrographs accompany the article.—*E. S. Reed, M.D.*

Lindskog, G. E., Liebow, A., Kausel, H., and Janzen, A. Pulmonary arteriovenous aneurysm. *Ann. Surg.*, Oct., 1950, *132*, 591–610.

The authors present an excellent review of the subject, attach a full bibliography, and add 4 case reports to the literature. Three of these were treated by lobectomy. The pathologic anatomy of the lesions was studied and illustrated by the vinylite-plastic injection technique.—*George Cooper, Jr., M.D.*

Hwang, W., Prec, O., Kuramoto, K., Segall, S., and Katz, L. N. Hemodynamic study of a case of anomalous pulmonary venous drainage. *Circulation*, Oct., 1950, *2*, 553–557.

This is a case report of one of the rare cardiac anomalies studied by right heart catheterization and angiocardiography. There was nearly complete pulmonary venous drainage into the left superior vena cava and the right auricle. Angiocardiography demonstrated the presence of an interauricular septal defect with the anomalous return of the pulmonary veins. Clinically such cases must be distinguished from other cases of cardiac anomaly which are amenable to surgery. Such cases as this can only be diagnosed with the aid of angiocardiography and right heart catheterization. Most of these cases die very early in life.—*E. C. Baker, M.D.*

Kaye, Josse, and Meyer, R. M. Kartagener's syndrome with an anomalous left subclavian artery. *Brit. J. Radiol.*, Jan., 1951, *24*, 27–30.

In 1933 Kartagener was the first to point out the increased frequency of bronchiectasis, with sinusitis, in cases of situs inversus. The incidence of bronchiectasis in dextrocardia has been recorded as between 16 and 21 per cent.

A brother and sister were examined clinically and roentgenographically. The girl, aged twenty-two, was found to have complete situs transversus, bronchiectasis in each lower lobe, bilateral maxillary sinusitis, and an anomalous origin of the left subclavian artery. The subclavian artery apparently arose from the left side of the aorta, passing behind the esophagus, thus presenting a mirror image of the anomaly seen when the heart and aorta are not reversed.

Her brother, aged twenty, was asymptomatic, but was found to have dextrocardia, fusiform dilatation of the bronchi in the lower lobes, and a history of a previous roentgen diagnosis of sinusitis.

Both parents were examined, but had no demonstrable abnormality with a chest roentgenogram and a barium meal.—*E. F. Lang, M.D.*

Hallenbeck, George A., Wood, Earl H., Burchell, Howard B., and Clagett, O. Theron. Coarctation of the aorta; the relationship of clinical results to cardiovascular dynamics studied before, during, and after surgical treatment. *Surg., Gynec. & Obst.*, Jan., 1951, *92*, 75–80.

After resection for stricture and end-to-end anastomosis of the aorta in a group of 31 patients varying in age from eleven to thirty-eight years, approximately 50 per cent presented the clinical picture of a "cure" and more than 90 per cent were either clinically cured or improved. Equalization of pressures above and below the site of stricture is one but not the sole factor determining the clinical result.

Because of occasional apparently good clinical results associated with poor laboratory results, clinical data alone cannot always be relied on to establish the anatomic adequacy of the anastomosis.

Both clinical and laboratory data indicate that end-to-end anastomosis of the aorta gives better results than end-to-end anastomosis of the left subclavian artery to the aorta.

After operation neither clinical status nor laboratory measurements are static. For some reason, both tend to improve with time. Regression, though it may occur, is comparatively rare, at least in the first year or two after operation.

The present report is necessarily of an interim nature. As is so often the case with new procedures, much more time will be required to evaluate this treatment. The results insofar as they can be appraised at present are most encouraging and justify the efforts being made to aid sufferers from this congenital malady.—*Mary Frances Vastine, M.D.*

Hyman, Albert L., Levy, Louis, II, Bagnetto, Richard, Ordway, Nelson K., and Hull, Edgar. Isolated disease of the pulmonary valve and artery. *Ann. Int. Med.*, Jan., 1951, *34*, 90–113.

Seven cases of isolated pathologic lesions of the pulmonary valve or artery are reported.

In 6 of the cases, the presence of systolic and diastolic murmurs brought up the possibility of a patent ductus arteriosus. The machinery murmur of a patent ductus arteriosus is continuous throughout systole and diastole in most cases. In the present 6 cases there was a to and fro murmur.

A diagnosis of congenital isolated pulmonary stenosis was made in 3 patients and of acquired pulmonary stenosis and insufficiency in 2 patients, due in one to rheumatic infection and in the other to bacterial endocarditis. Two patients had pulmonary artery aneurysms, one on a syphilitic and the other on a mycotic basis.—*C. P. Truog, M.D.*

Steinberg, Israel, McCoy, Herbert I., and Dotter, Charles T. Angiocardiography in artificial pneumothorax. *Am. Rev. Tuberc.*, Oct., 1950, *62*, 353–359.

The angiocardiographic findings in the pulmonary circulation of 23 patients before, during and after artificial pneumothorax are described and illustrated. There is a definite decrease in the vascularity of local areas of the lung involved by tuberculosis. Following artificial pneumothorax there is a decrease in vascularity and a delay in the rate of blood flow in the collapsed lung. The greatest diminution in vascularity is in the peripheral third of the lung. In fibrothorax following the re-expansion there is retraction and torsion of the cardiovascular structures to the affected side and decreased vascularity of the affected lung.—*H. T. Caumartin, M.D.*

Diefenbach, William C. L. Tuberculosis of the heart; a review. *Am. Rev. Tuberc.*, Oct., 1950, *62*, 390–402.

It has been estimated that some degree of involvement of the heart occurs in about 4 per cent of all cases of pulmonary tuberculosis. This paper presents a review of the literature on tuberculosis of the heart and discusses the signs, symptoms, and pathology, as well as the clinical significance. Tuberculosis of the pericardium is the most frequent type of involvement and is most commonly manifested as a pericarditis with effusion. The detection of fluid within the pericardium may, of course, be difficult, but the examination is facilitated by the use of angiocardiography. Tuberculosis of the myocardium and endocardium is rare and the diagnosis is generally not made during life. All forms of tuberculosis of the heart are probably always secondary to tuberculosis elsewhere in the body.—*H. T. Caumartin, M.D.*

Hirsch, W. Röntgenologische Betrachtungen bei Aneurysmabildung des Herzmuskels. (Roentgenologic observations in cardiac aneurysms.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Oct., 1950, *73*, 525–536.

An antemortem diagnosis of cardiac aneurysm was made in 6 of 25 patients by correlating the clinical and roentgenological findings. Sternberg differentiates 4 clinical stages: 1. Stenocardia—of short duration. 2. Pericarditis—with hyperpyrexia, signs of effusion or occasionally a friction rub. 3. Latent stage—with subjective improvement lasting for weeks or years. 4. Severe myocardial damage—with sudden fatality due to rupture or a slowly progressing decompensation. The most frequent site is on the anterior wall of the left ventricle near the apex, corresponding to the distribution of the anterior descending ramus of the left coronary artery. Aneurysms in other cardiac chambers are rare.

Roentgenographic findings may be absent if the aneurysm is small or is not contour forming. In typical cases there is a well defined, rounded bulge or, less often, a sharp angulation. Pulsations may be absent, shallow and usually paradoxical, expanding outward with systole as the neighboring, healthy musculature contracts. These findings may also be observed in kymographic examinations. Teschendorf was the first to demonstrate that the aneurysm becomes narrower and longer in the expiratory phase, plumper and shorter in inspiration. This alteration is not seen with cysts, diverticula or herniations, all of which are rare and occur most often on the right side. The differential diagnosis includes aneurysms of the aorta and pulmonary artery, tumors of the epi-, myo- and pericardium, pericardial diverticula and hernias, tumors or cysts of the mediastinum and encapsulated pleural effusions.—*Joseph Zausner, M.D.*

McKinnon, J. B., and Friedman, Ben. Electrokymographic studies of the left atrium in normal and diseased hearts. *Circulation*, Oct., 1950, *2*, 572–577.

This paper is a study of electrokymographic tracings taken in the right anterior oblique position of the left atrium. Two normal cases were studied and a small series of abnormal cases. Findings are related as accurately as possible to the clinical find-

ings. Discussion of the possible explanations of the change in the curves from normal is given. The authors believe that this method is of value in making a definite diagnosis in mitral insufficiency.—*E. C. Baker, M.D.*

Bayer, O. Die Bedeutung des Herzkatheterismus für die Diagnostik angeborener Angiokardiopathien. (The value of cardiac catheterization in diagnosis of congenital angiocardiopathies.) *Deutsche med. Wchnschr.*, Jan. 26, 1951, *76*, 101–105.

Cardiac catheterization which was first carried out by Forssman in 1929 was developed mainly by American investigators. Its value is established particularly in the congenital cardiac malformations associated with abnormal communication between the venous and arterial part of the circulatory system.

The author employs a modified radiopaque ureteral catheter of Cournand provided with a fine mandrin. The mandrin enables him to use a very soft catheter preventing its bending. The catheter is introduced into the vena basilica mediana of the left arm or, if this should be impracticable, into the vena saphena magna of the right thigh and pushed forward under fluoroscopic control and continuous injection of physiologic saline with vetren at body temperature.

Seventy cardiac catheterizations were carried out by the author and the experiences are reported. In 7 out of 10 cases of auricular septal defect, he was able to pass the catheter through the defect into the left auricle and pulmonary vein, thus confirming the diagnosis. Other malformations, such as dextraposition of the aorta, anomalous pulmonary veins and an anomalous vena cava superior, were also thus demonstrated.

The main value of this method, however, is in the chance to analyze the oxygen and carbon dioxide content of the blood in the different segments of the heart and great vessels, which has a great diagnostic importance. The results of analyses in 7 cases of congenital cardiac malformations are given schematically. Significant changes from the normal in the oxygen content in the different heart segments were found in cases of tetralogy of Fallot, Eisenmenger's syndrome, Lutembacher's syndrome and other abnormal communications between the right and left heart. The value of blood pressure measurements associated with blood gas analyses is stressed.

Six roentgenograms showing the opaque catheter in different sections of the heart and great vessels are presented. A list of seventeen references from continental and American sources is added.—*K. E. Matzinger, M.D.*

Bourne, Geoffrey, and Wells, B. G. Measurement of heart size. *Lancet*, Jan. 6, 1951, *1*, 17–18.

The authors resurrect and re-evaluate an older fluoroscopic method of measurement of the transverse diameter of the heart.

The apparatus is standard except that while the screen can be fixed, the tube moves freely. The patient is carefully placed and then with the diaphragm narrowed to a vertical slit, by moving the tube, the lateral margins, as seen through the slit, are marked on the fixed screen. The method is rapid, accurate and useful in following a heart in an office or clinic.—*G. H. Ramsey, M.D.*

Isaac, Frank, Wilkins, Franklin B., and Weinberg, Joseph. Traumatic and related types of diaphragmatic hernia. *Radiology*, Oct., 1950, *55*, 527–533.

The incidence of diaphragmatic hernia is now known to be considerably higher than was believed two or three decades ago. Esophageal hiatal hernia, which is acquired, is by far the most common. It is most often found in the middle-aged male, especially in the obese, and usually involves only a relatively small portion of the fundus of the stomach.

Non-hiatal hernia may be congenital, occurring through developmentally weak spots of the diaphragm, the foramen of Bochdalek or of Morgagni, or as a result of congenital absence of a portion of the diaphragm. It is often enclosed in a sac of pleura and peritoneum. More common is the acquired hernia which can be traced to trauma, with actual laceration of the diaphragm. There is no peritoneal sac and the abdominal viscera are in direct contact with the lungs. The hernia may be small and contain only omentum or may be massive and involve a large portion of the gastrointestinal tract.

Diaphragmatic hernia may be asymptomatic, or may cause vague complaints, often suggesting cardiac or respiratory disease. Occasionally there may be symptoms of an acute abdominal emergency or intestinal obstruction.

The chest roentgenogram should be the initial step in the investigation. Gas-containing stomach or loops of intestine are frequently visualized in the thoracic cavity. Often there may be merely a sharp tenting of the left dome of the diaphragm, obliteration of the costophrenic sulcus or an unexplained density in the left base. At times a well circumscribed spherical shadow is visualized in the left base, just above and inseparable from the diaphragm. A history of trauma to the chest and roentgenologic evidence of old rib fractures can frequently be obtained. Complete roentgenologic study of the gastrointestinal tract will in most cases establish the diagnosis. Eventration of the diaphragm may at times be confused with hernia.

Five case reports are included to illustrate types of non-hiatal diaphragmatic hernia.—*A. W. Sommer, M.D.*

Abdomen

Kerekes, E. S., and Ewing, John. Traumatic liver cyst. *Radiology*, Dec., 1950, *55*, 861–864.

Blunt force trauma to the abdomen injures the liver at least as often as it injures the spleen. The type of injury may be classified as "transcapsular" (more common) where the capsule is torn and hemorrhage to the peritoneal cavity results, and "subcapsular" where either a hematoma near the surface or a rupture deep in the parenchyma results. Cysts may arise from the cases of deep rupture.

Approximately 70 per cent of the patients with this type of injury die within six hours. In those who survive this period, hemorrhage, infection, peritonitis, ileus, liver emboli, jaundice, hepatitis, liver abscess, and the hepatorenal syndrome may complicate the picture. A cyst develops slowly, producing increased liver mass, right shoulder pain, and sometimes dilatation of the superficial abdominal veins.

Roentgen diagnosis of liver rupture is largely indirect, e.g., free peritoneal fluid, ileus, and organ displacements due to increased liver mass and/or rupture of the hemidiaphragm. The chest roentgenograms will show signs of a right subdiaphragmatic inflammatory process. The cyst may be demonstrated directly by aspiration of the mass and reinjection with air as was done in the single case reported. The treatment is surgical.—*M. B. Goodwin, M.D.*

Doran, F. S. A. Aetiology of chronic gastric ulcer; observations on the blood-supply of the human gastric mucosa with a note on the arteriovenous shunt. *Lancet*, Jan. 27, 1951, *1*, 199–202.

This paper represents a study of the arteriolar and capillary blood supply of the wall of the stomach, particularly the mucosa, in an attempt to determine whether impairment of blood supply precedes the production of gastric ulcer. The technique utilized is that first described by Barclay for obtaining microradiographs of capillaries in various organs. After injecting a suitable contrast substance to fill the capillary bed of the mucosa of the stomach, very thin microscopic sections are radiographed and the distribution of the vessels studied.

It was found that there is a diminished vascular density in the mucosa along the lesser curvature where gastric ulcer is most frequently observed. The presence of numerous arteriovenous shunts in the circulation in this region is described, and it is suggested that neurogenic influences may divert blood from the mucosa of the stomach by way of these shunts under certain circumstances. Nevertheless, the author concludes that the study has not given any clear-cut support for the opinion that diminished blood supply precedes the development of gastric ulcer.—*R. P. Barden, M.D.*

Beck, H. R. Über hochsitzende Magendivertikel. (Highly situated gastric diverticula.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1951, *74*, 47–59.

Based on his observations on 5 patients, the author suggests the term "autoplastic pseudodiverticula" for certain niche-like dilatations on the posterior wall of the fundus near the lesser curvature, where the fundus and cardia meet. The diagnosis should be considered especially in a cascade-type stomach associated with gastritis.

The pathogenesis is explained as follows: The gastric mucosa normally presents numerous digestion chambers (the areolae digestivae of Forssell). As a result of gastritis, there is a biphasic disturbance in innervation, which produces atony (sympathetic response) and adjacent spasm vagotonic contraction) of the muscularis mucosae. At this particular site in the fundus, the direction of the muscles changes from circular and arcurate to longitudinal; also, the muscular layer (fibrae obliquae) is very thin. Thus herniations of the mucosa occur. The role of the openings for vascular entry is minimized because the vessels at this level are smaller than elsewhere in the stomach. Other muscle layers do not participate in the process.

The roentgenological findings of differentiation between gastric ulcers and these diverticula are tabulated as follows:

	Ulcer	Pseudodiverticulum
1. Form of niche	variable (shaped like a pyramid, button, or funnel; oval or serrated)	button-shaped or oval
2. Base of niche	convex or concave	usually concave
3. Contour of niche	smooth or serrated	always smooth
4. With diminution in size	niche contracts to a point leaving a persistent fleck	niche becomes smooth and merges with normal gastric wall
5. Adjacent area	numerous folds converge towards the niche, especially in the healing phase	convergence is not typical
6. General mucosal pattern	gastritic	gastritic
7. Site of niche	any part of stomach	limited to fundus

—*Joseph Zausner, M.D.*

Holbrook, Arthur Andrews. The behavior of carob gum in the gastrointestinal tract of man. *Am. J. Digest. Dis.*, Jan., 1951, *18*, 24–28.

The swelling capacity of carob gum in a neutral or alkaline solution to more than seven times its original volume is demonstrated in vitro.

Carob gum-barium pelloids observed serially by roentgen rays after ingestion by normal individuals were seen to maintain their identity for the first three hours in the stomach and small bowel. The disintegration time for the pelloids approximated the ideal physiological timing in that they did not reach their maximal colloidal mass until they were in the colon, whereas psyllium gum-barium and karaya

gum-barium pelloids disintegrated much sooner and passed more rapidly through the gastrointestinal tract. In the colon and rectum all gums appeared to behave similarly.—*J. J. McCort, M.D.*

Gauss, Harry. The gastrointestinal syndrome of chronic brucellosis. *Am. J. Digest. Dis.*, Oct., 1950, *17*, 323–332.

Brucellosis happens to be endemic in Colorado as well as in other parts of the world, hence the author's attention has been focused on this disease for some time and he realized that this disease does not always conform to any set pattern, but has many clinical expressions including a strong gastrointestinal syndrome which may at times completely dominate the clinical picture, particularly in the chronic state.

Twenty case histories were selected for discussion where the patient presented an essential gastrointestinal history as the chief complaint, but where the subsequent study revealed the presence of a masked chronic brucellosis. The gastrointestinal symptoms seem to fall into four groups: (1) a predominant gastric irritation syndrome, (2) an irritable colon syndrome, (3) a biliary dyspepsia syndrome, (4) mixed syndrome.

The diagnosis of chronic brucellosis is difficult to make at times if not baffling and tantalizing. There is no pathognomonic sign for chronic brucellosis, while the clinical manifestations can be so varied and bizarre as to suggest the presence of various other clinical entities. Harris points out that the textbook description of early tuberculosis resembles the symptomatology of chronic brucellosis, namely fatigue, loss of weight, sweats, cough, slight elevation of temperature, mild chest pains, etc.; all apply equally well to chronic brucellosis as well as to early tuberculosis. Other writers have pointed out that the disease may simulate neurasthenia, psychoneurosis, bronchial asthma, early tuberculosis, influenza, anemia, syphilis, peptic ulcer, cholecystitis, appendicitis, ulcerative colitis, arthritis, rheumatism, typhoid, endocarditis, coronary disease, functional heart disease, backache, various skin disorders, as well as numerous other clinical entities. Indeed we may call brucellosis the great imitator.

There are four laboratory tests which are employed in establishing a diagnosis:

(1) The positive blood culture. This is the one infallible proof of brucellosis infection.

(2) The agglutinin test in a titer of 1:40 or over is considered to be presumptive evidence of the presence of brucellosis infection. Unfortunately, this test like the blood culture is too often negative. Negative agglutination tests have even been reported in patients in whom the organisms have been demonstrated in the blood.

(3) The opsonic index has been employed by some workers. Others regard it as a cumbersome unreliable test of little value in routine diagnosis.

(4) The intradermal skin test is the one test that has met with general approval. It is made by injecting 0.1 cc. brucellergen which is an insoluble protein nucleate fraction of a mixed culture of the *Brucella* organisms prepared by the Huddleson method. This test is considered to be practically 100 per cent specific when it is positive. There are no false positives. The test is read at forty-eight hours. The positive test indicates the presence of brucellosis infection which may be either active or quiescent. Huddleson states that "a diagnosis of the chronic form in many instances is being made on the basis of the skin test alone."

Brucellosis is a bacterial disease that elicits a very low antigen response in the body, so that by necessity it tends to become a chronic disease in its natural cycle. Even the newer and powerful antibiotics do not guarantee a cure, and Spink cautions that even when these are employed "patients treated for brucellosis should be followed for at least a year to evaluate the therapy." Perhaps we can learn a lesson from the history of tuberculosis with which it has so often been compared, by employing the terms "quiescent" and "arrested" rather than "cure."—*E. J. McDonald, M.D.*

Gillespie, James B. Perforation of duodenum by ingested foreign body; symptoms suggesting disease of the hip. *Am. J. Dis. Child.*, Oct., 1950, *80*, 600–605.

The case reported is that of a girl, twenty-four months of age, who when first seen complained of pain in the right hip and a pronounced limp. Because of persistent pain, roentgenographic studies of the hip had been made before admission to the hospital. No abnormality of the right hip joint was found but it was noted that the child had a broken bobby pin in the intestinal tract. Since there was no history of an ingested foreign body, it was impossible to determine when the incident had occurred. At operation, the two fragments were found in the duodenum, with perforation.

Gillespie thinks the occurrence of bizarre symptoms in a patient with a sharp or elongated foreign body lodged in a portion of the intestinal tract should suggest the possibility of perforation. The complaints of limp and pain in the hip due to the indurated inflammatory area in the psoas region, such as occurred in his case, have not been previously reported. As a prophylactic measure, all elongated foreign bodies lodged in the stomach, the passage of which through the intestine might involve risk, could be removed by the gastroscope. Unfortunately, such service is not everywhere available. Should a foreign body remain in one location referable to a viscus for as long as a week, prompt abdominal section for removal is indicated.—*R. S. Bromer, M.D.*

Gillespie, James B., and Dukes, Richard E. Duodenitis in childhood. *Pediatrics*, Oct., 1950, *6*, 601–606.

Peptic ulcers have occasionally been reported in children but little attention has been paid to duodenitis. Duodenitis produces hyperemia and stippling of the serosa but no induration and no disease can be detected by palpation of the duodenum. Kirklin proposed certain criteria for the roentgen diagnosis of duodenitis: (1) increased irritability of the duodenum as shown by spasm and hypermotility; (2) coarse reticular mucosal pattern; and (3) absence of an ulcer crater.

According to the authors, the most prominent finding in duodenitis in children is the irritability of the duodenal cap at fluoroscopy. The films show reticular pattern of the mucosa due to edema or an indented contour as a result of swollen folds seen in profile. These indentations are inconstant as opposed to the scars of healed ulcers.

The symptoms are similar but milder as compared with the symptoms of uncomplicated ulcer. Epigastric pain, inconstantly relieved by food and alkalies, nausea, fullness, vomiting and night pain are the usual complaints. Hemorrhage in children is rare.

The authors report 6 cases of duodenitis in children, whose ages ranged from $3\frac{1}{2}$ to twelve years. All cases were diagnosed roentgenologically and had no operative confirmation. Five cases responded promptly to a modified ulcer regimen.

A plea is made by the authors for a higher index of suspicion toward the diagnosis of duodenitis in children with epigastric distress.—*R. M. Harvey, M.D*

James, A. H. Duodenal intubation with magnet-tipped tubes. *Lancet*, Jan. 27, 1951, *1*, 209–210.

By incorporating a small but powerful permanent magnet into the tip of a flexible tube for duodenal intubation, the position and progress of the tip of the tube may be determined by a properly placed compass on the abdomen. This method of duodenal intubation was proved practical by the author, both in adults and children. The compass proved correct in 82.5 per cent, the mistakes decreasing with practice in use of the compass, and increasing with obesity of the patient. The advantages over roentgenological determination are that, with the magnet-tipped tubes, examination may be made without transportation of the patient to the radiological department, without the possibility of overdosage, and without the use of serial films or the fluoroscopic screen. Efforts to pull the tube through the pylorus with a magnet were ineffective.

A special type of nickle-cobalt-aluminum alloy was used for the magnet with the alloy imbedded in the tip of the tube by dipping in crude latex.—*F. E. O'Neill, M.D.*

Fox, Paul F., and Brennan, James E. Ruptured omphalocele and jejunal atresia. *Ann. Surg.*, Jan., 1951, *133*, 123–126.

The authors observed the occurrence of two congenital anomalies in a newborn infant: one, a ruptured omphalocele, relatively rare, the other, a jejunal atresia which is more common. The former lesion was found at birth and was repaired surgically when the infant was twenty-one hours old. The patient did poorly and roentgen study, following the surgical procedure, disclosed the presence of the second congenital anomaly, associated with a very short and narrow intestine. Another operation was performed when the infant was forty-two hours old, and since then the child has continued to do well.

A roentgen examination at the age of nine months disclosed the distribution of barium throughout the small intestine within two hours after its ingestion. A barium study of the colon showed no evidence of abnormality.

The hazards of the use of barium for study of the upper gastrointestinal tract in an infant less than two days of age are discussed.—*Moris Horwitz, M.D.*

Railton, S. V. Diverticula of small bowel and their surgical significance. *Canad. M. A. J.*, Jan., 1951, *64*, 55–58.

This paper is limited to the discussion of diverticula of the small intestine, excluding those found in the duodenum and the congenital Meckel's diverticulum. Duodenal diverticula are fairly common and often demonstrated roentgenologically. They are frequently symptomless and difficult to treat surgically when present in the third and fourth portions of the duodenum.

Most small bowel diverticula are found on the mesenteric border. Only rarely do they occur on the antemesenteric side, when they are traced to ectopic sites of the terminal blood vessels to the bowel.

The diverticula of the small bowel are usually multiple and vary greatly in size and number, sometimes extending along the full length of the small intestine. They may be thickly congregated or may be sparsely distributed. Occasionally their presence is restricted to a short segment. As a rule, the wall of the sac contains few or no muscle components, but only mucosa and serosa.

In acute emergencies caused by late complications of small bowel diverticula, the symptoms and signs are those of an acute abdomen of perforation, inflammation or obstruction. The correct diagnosis is usually made at operation.

In chronic cases no definite symptoms are present except flatulence and a heavy oppressive feeling or some unexplained discomfort in the abdomen. It is only after careful roentgen studies of the small intestine are made that the diverticula are discovered. Useless surgery or the labelling of patients as neurotics may result from not looking for diverticula in patients with obscure abdominal complaints.

Acute emergencies should be subjected only to essential treatment. Hemorrhage should be controlled in the most logical way; obstruction should be relieved; perforation should be closed.

The chronic cases cause more controversy as regards treatment. If the diverticula are large or show prolonged retention, and involve only a short segment of the bowel, operation is indicated, consisting of resection. Whether a lateral or an end-to-end anastomosis is performed is immaterial. It is believed that an average of 5 feet or slightly more of bowel can be resected without imperiling the digestive function of the small intestine.

The author reports in detail the case of a plant executive, aged forty-eight, who had a history of ulcer which finally healed. However, since the complaints persisted, a complete roentgen study of the small intestine was made. This revealed several large pouches with fluid levels and barium retention, the largest measuring about 2 inches in diameter. Smaller pouches were noted farther along in the bowel, affecting a segment probably not more than 2 to 3 feet in length. The pouches did not begin for several inches past the ligament of Treitz. At operation the diverticula were found as expected. In all, about 30 inches of jejunum were resected and a side-to-side anastomosis was done. The patient was discharged on the eleventh day postoperatively in good condition. Two months after operation, he had little or no digestive trouble.—*S. N. Tager, M.D.*

Bücker, J., and Feindt, H. R. Pseudopolyposis lymphatica ilei (Pseudoileitis). *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1951, *74*, 59–65.

The roentgenographic appearance of non-sclerosing ileitis, described by others, is characterized by a reticulated mucosal pattern with or without demonstration of tiny nodular elevations of the mucosa. The authors observed lymphatic hyperplasia of the terminal ileum in 5 patients who had no evidence of ileitis. One patient had a generalized adenopathy. The same roentgenographic findings were demonstrable whether gastrointestinal symptoms were present or not. Histopathological examination in 1 case showed lymphatic hyperplasia without evidence of inflammatory changes.

The authors prefer the term pseudopolyposis if no signs of ileitis are present. The condition is ascribed to a congenital or a functional hyperplasia of the lymph follicles in the terminal ileum.—*Joseph Zausner, M.D.*

Raftery, Alan, Trafas, Peter C., and McClure, Roy D. Histoplasmosis; a common cause of appendicitis and mesenteric adenitis. *Ann. Surg.*, Oct., 1950, *132*, 720–728.

In view of the growing appreciation of the responsibility of histoplasmosis for abnormal findings in the chest roentgenogram, this study of 2,135 cases of appendicitis and mesenteric adenitis seen in a ten year period at the Henry Ford Hospital, Detroit, is of interest to all roentgenologists.

By morphologic study, culture, or animal inoculation, histoplasmosis was demonstrated in 5 per cent of the cases of appendicitis and in 43 per cent of the cases of mesenteric adenitis. Lymphoid hyperplasia was the predominant histopathologic finding. Review of the case histories revealed a clinical picture of recurrent abdominal discomfort, low grade fever, and acute exacerbation of abdominal pain. Unfortunately only 13 of the patients had chest roentgenograms, but of these, 12 showed hilar enlargement and pulmonary infiltration with calcification. Of these 12, the 9 patients who had tuberculin tests gave negative reactions.

Though the number of chest studies is small, it would seem wise for the roentgenologist to suggest lymphoid hyperplasia due to histoplasmosis as the cause of abdominal discomfort when he encounters the combination of the above chest findings and clinical picture.—*George Cooper, Jr., M.D.*

Hellsten, Helge, and Ramström, Sven. Coexistent cecal cancer and appendicular abscess. *Arch. Surg.*, Jan., 1951, *62*, 112–117.

Statistically, cancer of the cecum is not a common disease. The authors quote Cattell as stating that approximately 6 per cent of all cancers of the colon occur in the cecum.

This paper is limited to the study of cecal carcinoma as manifested initially by symptoms of abscess in the region of the appendix. It is pointed out that it is not always apparent from the case histories reported in the literature whether the abscess was the result of appendicitis or whether it had been caused by perforation of the cancer or ulceration of the latter with infection and lymphatic spread.

From 1939 to 1950, 28 patients with carcinoma of the cecum were cared for at the Surgical Clinic II of Sahlgren's Hospital, Göteborg, Sweden. In 7 of these the clinical symptoms were those of abscess in the right lower quadrant and in 4 the abscess had probably developed from a coexistent appendicitis.

The authors postulate that cecal cancer may constrict the base of the appendix, with resultant secretory retention and subsequent appendicitis or that ulceration of the tumor with secondary infection may lead to spreading of the infection by continuity, or by way of the lymphatic vessels and thereby cause appendicitis.

The most important fact to be borne in mind in the treatment of an abscess in the region of the appendix, especially in elderly patients, is the possibility of its being secondary to cecal cancer. In other words, the finding of a gangrenous appendix is not always sufficient to explain an abscess in this region. When treating young patients for an abscess in the region of the appendix by drainage only, most surgeons advise the patients to undergo appendectomy on a later occasion. This will show the presence or absence of coexistent cancer. However, in the treatment of elderly patients, it is debatable whether reoperation is always advisable, unless definitely indicated. If malignant infiltration of the cecum cannot be excluded at

operation, roentgenologic examination should be resorted to. Careful study of the colon will generally reveal cecal cancer if it is present.—*E. A. Addington, M.D.*

Laufman, Harold, and Saphir, Otto. Primary linitis plastica type of carcinoma of the colon. *Arch. Surg.*, Jan., 1951, *62*, 79–91.

This is a most interesting clinical and pathological study on infiltrating carcinoma of the colon resembling phlegmonous inflammation. Four case reports are included.

Clinically, the condition is practically never diagnosed as carcinoma, since it tends to mimic certain other diseases, such as ulcerative colitis, or it may elude recognition altogether. Coincident with the tumorous growth there is a subacute and chronic inflammation, with much new formation of connective tissue. Because of the fast spread of the inflammatory lesion and of the individual cancer cells, large portions of the organ are often involved.

Histopathologically, it may likewise be difficult to determine the true nature of the lesion. Though it usually represents an adenocarcinoma, many of the infiltrating cells form only abortive glandular structures spreading in small groups or even singly into neighboring areas. These cells still seem to maintain the ability to produce a secretion with compression of the nuclei, thus giving rise to typical signet ring-shaped tumor cells. Also, many undifferentiated cells with large irregular hyperchromatic nuclei are present, resembling monocytes or atypical lymphoblasts rather than carcinoma cells.

In none of the 4 cases reported in detail was the diagnosis made before operation, or antemortem. One case was diagnosed at laparotomy; in another the diagnosis was suspected clinically, but not made until necropsy; in the third case, examination of the peritoneal fluid revealed the presence of signet ring cells, and in the fourth case the diagnosis defied all measures and was only established at postmortem examination.

The metastasis to the ovaries in the 3 female patients in this series is noteworthy. In contrast to other types of carcinoma of the colon, there was no involvement of the liver. Two of the 4 patients had chronic ulcerative colitis in addition to the carcinoma. The authors tend to minimize the association of the unusual type of malignancy with the ulcerative colitis because they contend that the malignancy so commonly found secondary to ulcerative colitis is a polypoid type of malignancy, occurring singly or multiply, whereas in all of their cases the carcinoma was a diffusely spreading type of tumor. Also, 2 of the cases did not have an ulcerative colitis superimposed.—*E. A. Addington, M.D.*

Madison, Mitchell S., and Bargen, J. Arnold. Fulminating chronic ulcerative colitis with unusual segmental dilatation of the colon; report of case. *Proc. Staff Meet., Mayo Clin.*, Jan. 3, 1951, *26*, 21–24.

Recently a review of 2,000 cases of chronic ulcerative colitis seen at the Mayo Clinic showed local complications in 35 per cent of the cases: polyps in 19 per cent, strictures in 11 per cent, malignant neoplasms in 5 per cent, perforation in 2 per cent, perforation with the formation of a fistula in 2 per cent and massive hemorrhage in 1 per cent.

A case of fulminating chronic ulcerative colitis complicated by a segmental dilatation of the colon without obstruction is reported. A white clerk, aged forty-nine, twelve years after onset of his illness presented himself at the Clinic with a fulminating recurrence of his symptoms. The abdomen was distended and tender. A roentgenogram showed an acutely distended viscus. On the thirty-second day a roentgenogram of the colon revealed the transverse colon to be the distended area. Seven and one-half months later the transverse colon had returned to normal size and tone. The descending sigmoid and rectum showed marked narrowing and shortening.

No reason is suggested for the local dilatation of the colon. The patient did well under medical treatment.—*G. H. Ramsey, M.D.*

Clay, Richard C., and Hanlon, C. Rollins. Pneumoperitoneum in the differential diagnosis of diaphragmatic hernia. *J. Thoracic Surg.*, Jan., 1951, *21*, 57–70.

The use of mass roentgenological chest surveys has resulted in the detection of numerous asymptomatic thoracic lesions which present a real problem in diagnosis and treatment. Thoracotomy is often advised primarily for diagnosis. Operation could often be avoided if more accurate non-operative diagnostic methods were available. Most of these lesions are clearly above the diaphragm but those low in the lung may be confused with subdiaphragmatic processes.

Pneumoperitoneum and subsequent roentgenograms were used in 4 patients who were thought to have a low lying intrathoracic mass. In all 4 reported cases this was found to be a diaphragmatic hernia.

The authors discuss the reported fatalities from pneumoperitoneum. Most of the deaths were due to air embolism which can be avoided by careful performance of the pneumoperitoneum. With proper precautions they believe that it is a relatively safe procedure.—*T. C. Stansbury, Jr., M.D.*

Larkin, John C., Jr., and Phillips, Samuel. Intraperitoneal hemorrhage occurring as a complication of pneumoperitoneum. *Am. Rev. Tubere.*, Jan., 1951, *63*, 116–118.

Although serious complications of pneumoperitoneum are not common, the procedure is certainly not without hazard.

The present case report is concerned with a patient

who developed a massive intra-abdominal hemorrhage following a therapeutic pneumoperitoneum. Although the source of the bleeding was not discovered at laparotomy, it seemed most likely that it resulted from puncture of a vessel or from a ruptured vascular adhesion. Following removal of the free blood by suction and the institution of supportive measures, including whole blood transfusions, the patient had an uneventful postoperative course and survived.—*H. T. Caumartin, M.D.*

Ayres, R. W., Beeson, C. R., and Scruggs, Joe B., Jr. Idiopathic pneumoperitoneum; review of the literature and report of one case. *Am. J. Digest. Dis.*, Oct., 1950, *17*, 345–347.

"Spontaneous pneumoperitoneum" is defined by Mason, Mason and Kesmodel as the presence of free air in the peritoneal sac unassociated with any intentional procedure. The authors believe that the term idiopathic pneumoperitoneum would be more descriptive of the pneumoperitoneum of unknown etiology, in contrast to conditions such as perforating peptic ulcer, with associated spontaneous pneumoperitoneum.

There is one condition associated with pneumoperitoneum which has not been described in the recent English or American literature. As reported by Stenstrom, this is the condition known as pneumatosis cystoides intestinalis or emphysema bullosum intestinale. This condition was first described in swine in 1823 and first reported in the human by Bang, in 1816, being found in the course of an autopsy. In 1889 Hahn diagnosed the condition during a surgical procedure. In all, there are some 150 cases of this disease recorded. It is characterized by the formation of many cysts, ranging from the size of a pea to the size of a human fist. These are generally located on the small intestine but they have also been noted on the colon, stomach, diaphragm, omentum and have been found in associated lymph glands. The cysts are noted to be gas filled, the composition of which is unlike that of any of the other gases of the intestinal tract. There are differences of opinion as to its physical properties, which question has not been settled up to this time. The microscopic picture is equally vague, the only positive findings being the presence of giant cells in the wall of the cyst.

The authors review the literature with regard to the etiology of idiopathic pneumoperitoneum and have added the case of a fifty-three year old male with a history of symptoms referable to the gastrointestinal tract for the past twenty seven years. Roentgen examination revealed the presence of free air beneath both leaves of the diaphragm with no demonstrable acute lesion of the gastrointestinal tract. A 70 per cent gastric retention at six hours and some old deformation of the duodenal bulb were the only positive findings. Some three months after the initial hospitalization the patient was again roentgenographed and there was no evidence of free gas in the abdominal cavity.

Study of the British and American literature for the past twenty years would lead one to believe this an infrequently found condition. The foreign literature, however, suggests that there are many cases, the etiology of many of which is probably due to a cystic disease of the intestinal tract known as pneumatosis cystoides intestinalis. This pathology should be sought for more closely by the surgeon and pathologist in order to better determine the true etiology of idiopathic pneumoperitoneum.—*E. J. McDonald, M.D.*

Mosca, Lidio G. Das retroperitoneale Emphysem (rE), eine neue Aufnahmetechnik. (Retroperitoneal emphysema (rE), a new roentgenographic technique.) *Röntgen-Blätter*, Jan., 1951, *4*, 1–11.

Previously injection of gas into the perirenal space or into the retroperitoneal region at the flank has been used to demonstrate the kidneys, adrenals and other retroperitoneal organs. In 1948 M. Ruiz Rivas of Spain introduced the method of air injection in the retroperitoneal space whereby one injection sufficed to show the entire retroperitoneal area. This method was taken up by Mosca and utilized in 120 cases. He believes that it has the following advantages over other methods: (1) no anesthesia is required and the injection technique is simple, (2) by a single puncture both kidneys and surrounding structures are visualized, and (3) mortality is extremely low.

Technique. The patient is placed in the knee-chest position, the sacrococcygeal area sterilized, and the puncture made by a lumbar puncture or intramuscular needle according to the patient's size. Local anesthesia may be used or omitted. The puncture can be made in two different regions: (1) 1 cm. beyond the sacrococcygeal articulation, where the needle is directed upward, inward and a little forward until the anterior surface of the sacrum is reached, or (2) at the height of the anococcygeal fold the needle is directed upward, inward, and forward until the anterior surface of the coccyx is reached. By these two techniques the tip of the needle lies in the presacral space in direct contact with the subpelvic and retroperitoneal tissue of the pelvis. Negative pressure is exerted to determine if a vessel has been punctured and the air or oxygen injected, usually 1 to 2 liters, depending upon the patient's size. There are two methods of control: (1) by fluoroscopy the air is followed until the contour of both kidneys is clearly seen, and (2) the lumbar region is percussed while the gas is being injected until a tympanitic note can be produced.

Roentgenographic Technique: Preparation of the patient's bowel is very important to avoid confusing shadows. The film should be exposed with about 15–20 kv. less than is usually employed for abdominal

films due to the greater penetrability of gas-filled tissues. The author's technique for a 20 cm. thick abdomen is 40–45 kv., 100 ma., 1 sec. For supine films compression of the lower abdomen is added. The adrenals are best visualized in upright films.

Reaction. The method was employed in 120 patients ranging in age from six months to seventy-three years without accident. During injection the subject complains of abdominal pain especially in the flanks. The pain is not severe and disappears in about one-half hour. No nausea or vomiting occurs. Air may dissect to the mediastinum and neck and produce transient swallowing difficulty and voice changes. The air is completely resorbed in five to seven days. The possibility of air embolus can be reduced by use of nitrous oxide.

Interpretation of films. Normally in anteroposterior films there is air around both kidneys, even in the perirenal fat. The kidney hila, pelves, calyces, and ureters can often be outlined. In lateral views the complete posterior surface of the kidney is seen (this is the only roentgen method by which this is possible according to the author). In oblique projections the under surface of the liver and the spleen are well visualized. An enlarged gallbladder was demonstrated by the author in 1 case. The combination of retroperitoneal emphysema and urography (intravenous or retrograde) shows the entire kidney parenchymal contours and their relationships to the excretory system.

In malignant kidney tumors the combination of retroperitoneal emphysema with urography shows the extent and form of the neoplasm and its relationship to the surrounding tissues—an important surgical consideration.

Benign renal tumors and adrenal tumors are well delineated by this method. Hydronephrosis can be investigated by the combined urography and air injection technique to show the width of remaining parenchyma.

Multiple films illustrate the usefullness of this technique.—*Harold Fulton, M.D.*

DE GENNES, LUCIEN, MAY, J. P., SIMON, G., and BENZECRY, I. Sobre el retroneumoperitoneo; un nuevo procedimiento de exploración radiológica del abdomen. (Concerning retropneumoperitoneum; a new procedure for the roentgen examination of the abdomen.) *Prensa méd argent.*, Jan. 26, 1951, *38*, 171–175.

In order to facilitate the roentgen examination of the solid viscera such as liver, spleen, kidneys, adrenals, etc., gas has been introduced into the retroperitoneum as a contrast medium. The gas which can be either oxygen or a mixture of ⅓ carbon dioxide and ⅔ oxygen is injected under 300 grams pressure with an intramuscular needle not more than 4.0 cm. in length. The patient is prepared with a low residue diet forty eight hours before the examination and repeated cleansing enemas, the last being given one hour before the examination. Immediately before the administration of the gas 1.0 cc. of prostigmine (Roche) is given. With the patient in a knee-chest position, the skin is prepared with an antiseptic and the needle is introduced in the first maneuver 1.0 cm. anteriorly in the direction of the tip of the coccyx; it is then tilted toward the anococcygeal fold and and introduced an additional 1.0 cm. Once in the retrorectal space, the needle is connected with the apparatus and 1,000 to 1,200 cc. of gas introduced in two or three minutes. The patient is allowed to rest quietly in a semi-recumbent position for one hour to permit the gas to disperse. Other procedures such as urography, barium enema, etc., can then be carried out.

In over 150 examinations by this method the reactions were minimal and there were no serious sequelae.—*M. M. Friedman, M.D.*

KOBACKER, J. LESTER. Congenital absence of the gall bladder—a possible hereditary defect. *Ann. Int. Med.*, Oct., 1950, *33*, 1008–1012.

Congenital absence of the gallbladder is a rare anomaly, only 71 cases having been reported from 1900 to 1947. Most writers have favored the chance embryologic failure of the anlage to develop as the sole factor causing the anomaly. No mention has appeared regarding the possibility that heredity, rather than chance, determines the appearance of the anomaly.

Most of the patients have evidence of biliary disease. Gaseous indigestion, intolerance of fats, pain, and occasional jaundice are some of the manifestations. However, there are no specific signs or symptoms to aid in the clinical diagnosis and it has been said that no case of congenital absence of the gallbladder has been properly diagnosed before operation or autopsy.

The author presents a case of a forty-three year old woman who on surgery was found to have absence of the gallbladder. Subsequent to this the patient's sister was seen with biliary complaints. Both oral and intravenous cholecystographic studies showed non-visualization of the gallbladder. The possibility that she too might have congenital absence of the gallbladder was considered and surgery done one year later bore this out. A study of other members of this family was thus stimulated. Of 5 sisters having cholecystographic studies, 3 showed non-visualization of the gallbladder. An eighteen year old daughter of the second operated case also showed non-visualization and an eighteen year old daughter of a sister with possible agenesis also showed non-visualization. All the abnormal cases had mild to moderate dyspeptic complaints.

In view of the striking incidence in the reported

family, the author feels that there is evident need for attention to the possibility that absence of the gallbladder is a hereditary anomaly. He feels that a nonvisualization of the gallbladder merits especial notice in any family in which a congenital absence already has been established.—*G. J. Culver, M.D.*

Urrutia, J. M., and Lavezzo, Pablo. Pharmaco-cholangiography in the diagnosis of odditis. *Radiology*, Jan., 1951, *56*, 80–83.

Except for odditis, organic lesions of the distal choledochus may be differentiated from spasm on the operative cholangiogram. Odditis is a chronic inflammatory process tending to narrow the lumen and simulate spasm on the choledochogram.

A splanchnic block with novocaine and alcohol prior to surgery is used to relax the sympathetic innervation to the sphincter, followed by an operative cholangiogram and cholecystectomy. If the cholangiogram shows retention in the biliary tree, 3 drops of 1 per cent nitroglycerin are placed under the tongue to relax the vagus innervation and another cholangiogram obtained. A third film may be taken five minutes later if there is still poor drainage to the duodenum. In over 100 cases, 4 per cent showed little or none of the contrast medium entering the duodenum, presupposing an organic lesion of the choledochus.—*M. B. Goodwin, M.D.*

Doubilet, Henry, and Mulholland, John H. Surgical treatment of calcification of the pancreas. *Ann. Surg.*, Oct., 1950, *132*, 786–797.

The deposition of insoluble calcium salts in the ducts and acini of the pancreas is a not uncommon consequence of recurrent pancreatitis. The direct cause of this chemical abnormality is not known, but it should be remembered that its occurrence is an insignificant incident in the course of a disease entity. Calcium deposition does not alter treatment, symptomatology, or prognosis.

In the past, surgical procedures have often been directed at the incidental manifestations of recurrent pancreatitis—pain and calcification—rather than at the disease. Pancreatectomy, though relieving pain in some patients, has been followed by poor results in terms of mortality, resultant diabetes, and digestive disturbances. Removal of the calcium deposits is illogical. Interruption of the autonomic nerve fibers relieves pain but not the diarrhea, fat intolerance, diabetes, and poor nutrition.

Archibald has suggested that diversion of bile into the pancreatic ducts is the cause of recurrent pancreatitis, and that the diversion is brought about by spasm of a sphincter of Oddi distal to a common biliary-pancreatic passageway. On this basis, the authors have treated 73 patients with recurrent pancreatitis, 4 of whom exhibited roentgenographic evidence of pancreatic calcification, by section of the sphincter of Oddi.

In general, the operation is followed by arrest of the progress of the disease. The recurrent attacks cease, residual external and internal pancreatic function is salvaged, and pain is abolished. The calcifications persist unchanged.—*George Cooper, Jr., M.D.*

Gynecology and Obstetrics

Weisman, Abner I. The gynograph, a new improved gynoroentgenologic apparatus for use in conjunction with fluoroscopy and radiography of the female genital tract. *Radiology*, Jan., 1951, *56*, 104–107.

The instillation of foreign material into the uterus and fallopian tubes is not without danger. The author has developed an apparatus, the gynograph, with which he has performed over 2,000 uterotubal examinations without a single serious complication. This apparatus affords manometric control of pressure, continuous fluoroscopy, and the use of minimal amounts of opaque media.

A preliminary gaseous (carbon dioxide) insufflation is performed, followed by the instillation of small amounts (4 cc.) of the opaque substance, succeeded, in turn, by a second insufflation of gas. Unless patency is established, the opaque substance is not injected.—*E. M. Cooper, M.D.*

Dockerty, Malcolm B., and Mussey, Elizabeth. Malignant lesions of the uterus associated with estrogen-producing ovarian tumors. *Am. J. Obst. & Gynec.*, Jan., 1951, *61*, 147–153.

The coexistence of uterine carcinoma and functioning or feminizing ovarian neoplasms has been observed by several writers and the possible role of estrogens as carcinogenic agents suggested.

Dockerty and Mussey at the Mayo Clinic in a study of 87 granulosa cell and theca cell tumors noted the association of uterine and ovarian lesions in 15 cases (over 15 per cent) and after fifty years of age the incidence was 27 per cent. They present 16 short case histories of patients with granulosa or theca cell tumors associated with malignancies of the uterus; 3 patients also had breast tumors.

Granulosa and theca cell tumors differ from other ovarian tumors in that they produce estrogen. Experimentally, carcinoma-like lesions have developed on cervices of mice receiving estrogens. A high incidence of metastasizing fundal carcinomas was found in rabbits with impaired liver function (circulating estrogens not broken down).

Clinically, uterine and breast cancers are rarely observed after oophorectomy. Ayre and Bauld found that vaginal smears of women with malignant uterine lesions showed a sustained estrogen activity. Speert noted a high incidence of fundal carcinoma among patients with cirrhosis and a high concentration of circulating hormones.

McVicker found the coexistence of mammary and uterine adenocarcinoma to be 2.4 times as great as would be expected on the basis of chance alone. In the present study, if ovarian tumors were added to the coexisting mammary and uterine adenocarcinomas, the number of cases would be 17 times that expected on the basis of chance.—*Martha E. Mottram, M.D.*

Abt, Kurt. Die Spontanwendung bei Foetus mortuus. (The spontaneous version of dead fetus.) *Radiol. clin.*, Jan., 1951, *20*, 50–54.

The author presents in detail 2 cases in which a spontaneous version of the fetus occurred after intrauterine death, and reproduces their respective roentgenograms which are unusual in the sense that they serially demonstrate the version from the cephalic into the breech presentation.

The 2 cases were observed at the University Clinic of Basel and are published because it is generally assumed that a spontaneous version of a dead fetus is an impossibility due to the absence of fetal movements. There was no increase in the amount of the amniotic fluid and no labor pains accompanied the version.—*T. Leucutia, M.D.*

Levi, Leo M., and Haig, Pierre V. Chorionepithelioma of the uterus; résumé of the literature and presentation of two cases. *Radiology*, Jan., 1951, *56*, 73–79.

Two patients with chorionepithelioma who are alive and well seven and seven and one-half years respectively after the discovery of the disease are described. One had metastasis to the bladder and lungs while the other had metastasis to the lungs and vagina. The former was discovered through its metastasis to the bladder and was treated with a total tumor dose of 3,100 r of roentgen therapy. A panhysterectomy was carried out on the latter but the tumor had spread beyond the genital tract. Following surgery, the patient was treated with a total tumor dose of 1,650 r of roentgen therapy to the parametrial regions. Factors, portal size, and other considerations are given in detail. In both patients, the metastasis to the lungs appeared on the roentgenograms of the chest after roentgen therapy to the pelvic regions had been carried out, and then disappeared spontaneously, no roentgen therapy having been given to the chest.—*M. B. Goodwin, M.D.*

Dilworth, E. E., Mays, C. R., and Hornbuckle, L. A. Chorionepithelioma; a study of fifteen cases. *Am. J. Obst. & Gynec.*, Oct., 1950, *60*, 763–772.

The authors discuss 15 cases from their hospital files. Of this group only 3 patients were over thirty years old. One case was diagnosed as syncytioma or syncytial endometritis and really should not be classified as being malignant. Chorioadenoma destruens is also known as invasive mole or malignant mole. It carries an excellent prognosis and clinical metastases are almost unknown. Three cases had this diagnosis. The third group, choriocarcinoma or chorionepithelioma, included 11 cases. Microscopically these tumors were recognized by the wild growth of masses of trophoblastic cells invading the uterine muscle. All of this last group died. They all received roentgen therapy with no benefit. Early surgery is stressed.—*R. J. Reeves, M.D.*

Hildreth, R. C. Obesity—a complication in carcinoma cervix uteri. *J. Michigan M. Soc.*, Oct., 1950, *49*, 1175–1178.

Obesity was found present in 12 per cent of a series of 263 cases of carcinoma of the cervix and on review of survival rates there was found an absolute five year survival rate of 37 per cent in the obese individual as compared with 54 per cent in the non-obese group.

The reasons for this difference in survival rate may rest in the difficulty encountered in making an accurate estimate as to the clinical stage of the neoplasm. In treatment of obese patients it is urged that special methods be employed such as use of higher voltage and filter, increasing the treatment distance, use of a pressure cone and prolonging treatment in order to deliver an adequate tumor dose despite the handicap of thick overlying tissues.—*Robert Emerick, M.D.*

Baskin, Roy H., Jr., and Counseller, Virgil S. Struma ovarii causing ascites and hydrothorax (Meigs's syndrome). *Proc. Staff Meet., Mayo Clin.*, Jan. 31, 1951, *26*, 60–64.

The authors report a case of ascites and hydrothorax caused by a benign ovarian teratoma in which the solid element consisted of fetal adenoma type of thyroid tissue (struma ovarii).

The intrapleural fluid was on the right side, the usual side involved in this syndrome, and was complicated by a pneumothorax. The patient was treated by thoracocentesis through an indwelling catheter, through which constant negative pressure was applied for forty-eight hours. This was followed immediately by pan-hysterectomy. The postoperative course was uneventful, and the patient was discharged on the eleventh postoperative day.

There is a brief review of the literature, giving the postulated causes for the ascites and the hydrothorax.—*G. J. Culver, M.D.*

Finn, William F. Sarcoma of the uterus; review of thirty-three cases. *Am. J. Ost. & Gynec.*, Dec., 1950, *60*, 1254–1262.

Sarcoma of the uterus constituted 3.3 per cent of all genital tract neoplasms seen in the Women's Clinic at New York Hospital from 1933 to 1949. The

ratio of sarcoma to carcinoma was 1:30; 93 per cent of the patients were over forty years of age.

Thirty-three cases are reported; 13 endometrial; 18 myogenic; 2 unclassified. The chief symptoms were post-menopausal bleeding, abdominal pain, and the appearance of an abdominal mass.

Surgery is the treatment of choice and irradiation is not advised. The anatomical extent of the lesion is the most important factor in the prognosis. Thirteen patients in whom the lesion was confined within the uterus are alive, while only 1 in which the lesion was outside is alive. Metastases are the leading cause of death. Fourteen patients of the series are alive—7 less than five years. Of these, 2 had endometrial and 5 myogenic sarcoma. Seven (21 per cent) have survived five to seventeen years and 5 of these had endometrial and 2 leiomyosarcomas.—*Norman Heilbrun, M.D.*

Genitourinary System

Prather, George C. Effect of pregnancy on the urinary tract. *J. Michigan M. Soc.*, Jan., 1951, *50*, 41–44.

The pyelographic evidence of physiological hydronephrosis and hydroureter of pregnancy is usually seen first about the fifth month and reaches a maximum during the last trimester of pregnancy. It is more marked in primiparas than in multiparas. It occurs more frequently and more severely on the right side than on the left. Ureteral dilatation is confined to the segment of the ureter above the pelvic brim. The changes usually resolve completely within three months after delivery.

These changes apparently are due in part to compression of the ureters on the bony pelvic brim by the enlarged uterus. However, it frequently begins before the uterus is large enough to cause such pressure. Several experimental studies prove that there is a hormonal relaxation in the tone of the ureter and pelvic muscles. In one of the experiments the fetus of a rhesus monkey was removed, leaving the placenta in place until full term was reached. The hydronephrosis and hydroureter developed just as if the uterus had enlarged normally. Several similar experiments are quoted in which hydronephrosis and hydroureter occur with no appreciable enlargement of the uterus. It was assumed that the hydronephrosis was due to the effect of hormones on the musculature of these structures. The histological changes seen in these cases are thinning of the muscles and some separation of the muscle bundles in the ureters and renal pelves.

The anatomical changes which are described above apparently do not affect the renal function. If renal function is diminished then there was a pre-existing disease or an acute pathological process has developed during the pregnancy. Pyuria, renal pain and hematuria are discussed in this article regarding their differential diagnosis and clinical treatment.—*F. M. Windrow, M.D.*

Parks, Raymond E. The radiographic diagnosis of perinephric abscess. *J. Urol.*, Oct., 1950, *64*, 555–563.

Under the term perinephric abscess the author includes all infections of the perinephrium, whether true perinephrium or paranephric tissues. The condition is not common. The usual case has an insidious onset with vague symptomatology. The modern use of chemotherapy and antibiotics for undiagnosed fever may abort the acute symptoms and lead to a chronic form which may be more difficult to recognize. Approximately one-half of the reported cases have co-existent renal disease.

In the roentgenologic diagnosis of the disease the first important criterion is to suspect the condition. The author suggests the following method of investigation: (1) routine excretory urogram, including films in the erect position, to determine renal mobility; (2) bilateral retrograde pyelograms following the intravenous study; (3) posteroanterior and lateral views of the chest, including fluoroscopy; and (4) studies of the colon and upper gastrointestinal tract, dorsal and lumbar spines, and occasionally laminagraphy and perirenal air insufflation.

On the excretory urogram evidence of a mass in the kidney region should be sought for, including renal displacement. If the abscess is large, displacement of the colon may be revealed by barium enema studies. Comparison of the kidney position in the erect and supine positions will indicate the mobility and possible fixation of the kidney. The presence of an extrarenal mass and fixation of the kidney are the two most important diagnostic roentgen findings. Supplementary findings include absence of the psoas muscle shadow, curvature of the lumbar spine with the concavity of the curve directed toward the affected side, distortion of the renal pelvis from extrinsic pressure, loss of the renal shadow, and diminished renal function if the abscess is complicated by renal disease.—*R. M. Harvey, M.D.*

Abeshouse, Benjamin S. Serous cysts of the kidney and their differentiation from other cystic diseases of the kidney. *Urol. & Cutan. Rev.*, Oct., 1950, *54*, 582–602.

The author classifies the cystic diseases of the kidney and divides them into cystic lesions not communicating with the renal pelvis or calyces and cystic lesions communicating with the renal pelvis or calyx. Under the first group he classifies congenital polycystic disease, serous cysts, hemorrhagic cysts, parapelvic cyst, paranephric cyst, retention cysts, hydrocele of the kidney, and miscellaneous. Under the communicating cysts the author includes pyelogenic cyst, calyceal cyst, and hydrocalyx.

The term serous cyst is used to indicate a definite pathological entity which can be distinguished from other cystic lesions of the kidney. The name describes the cyst contents and is more desirable and specific than "simple" or "solitary" cysts. Serous

cysts are more commonly found in adults in the fifth, sixth and seventh decades of life and less frequently in children. The condition occurs equally in the sexes and there is no special predilection for the side involved. The exact pathogenesis of these lesions is not determined but arguments are propounded, suggesting that they may be either congenital or acquired.

The serous cysts are either superficial or deep, the latter being designated as medullary, papillary or intrarenal. While they may be single, it is not unusual to have multiple or bilateral cysts of this type and multilocular cysts may also occur. The size of the cyst may vary within a wide range, the superficial type usually attaining a larger size than the deep type. Superficial cysts appear as tense, thin-walled, translucent tumors, the appearance of which may be influenced by hemorrhage or infection. Usually these cysts contain a thin, clear, straw-colored fluid which is likened to the serous fluid in other body cavities. The walls of the cyst are lined with low or flat cuboidal epithelium.

Cysts of the kidney do not produce characteristic symptoms. A palpable mass may be the first evidence of such a lesion. Pain is present in from 50 to 70 per cent of the cases and may be in the upper abdominal quadrant or loin. In most instances the analysis of the urine shows normal findings.

Roentgenography is one of the most valuable methods of diagnosis. The survey film showing a change in the outline of the kidney and an increase in its size suggests a mass involving the kidney. In cases associated with trauma or repeated hemorrhage some calcification may be present in the wall of the cyst. Pyelographic findings may consist of elongation, dilatation, compression or distortion of the calyces; displacement of the kidney pelvis and calyces, dilatation, compression or obliteration of the renal pelvis or a change in the normal axis of the kidney with varying degrees of torsion.

Aortography and perirenal insufflation are also mentioned as roentgen methods for diagnosis of mass lesions of the kidney.

Differential diagnosis is not always easy. A distinction of a solid and a cystic mass involving the renal parenchyma cannot always be made on the basis of roentgen findings.

The treatment of serous cysts is surgical. The operative procedure should aim to preserve the kidney without jeopardizing the life of the patient.—*G. W. Chamberlin, M.D.*

Aldridge, C. W., and Mason, J. T. Ureteral obstruction in carcinoma of the cervix. *Am. J. Obst. & Gynec.*, Dec., 1950, *60*, 1272–1280.

The authors have analyzed 458 cases of cancer of the cervix seen from June, 1942, to January, 1947, in relation to the incidence of ureteral obstruction as shown by either intravenous or retrograde pyelography; 333 of the total number of cases had pyelograms. Abnormal findings (either hydronephrosis or non-visualization) were found in 144, or 34 per cent. This percentage agrees closely with the 40 per cent incidence of obstructions found at autopsy.

The findings of an abnormal pyelogram greatly influences the prognosis regardless of the clinical groups as shown in the following table:

Comparison of Survival Rates in Normal and Abnormal Pyelogram Groups

Clinical Group	Normal Pyelogram	Gross Survival All Cases 1942 to 1946	Abnormal Pyelogram
I	71%	97.5%	—
II	75%	82.5%	50%
III	77%	77.3%	14%
IVa	61%	64.4%	27%
IVb	46%	31.0%	12%
Total	62%	58.6%	16%

Sections of the obstructed ureters at autopsy usually demonstrated infiltrating neoplasm to be the cause of the ureteral obstruction.

The authors feel that early diversion of the urinary tract either by ureterosigmoid transplant or cutaneous ureterostomy is preferable to late nephrostomy drainage. Nephrostomy is indicated when pyelohydronephrosis is present.—*Norman Heilbrun, M.D.*

McCrea, Lowrain E., and Peale, Augustin R. Metastatic carcinoma of the ureter. *Urol. & Cutan. Rev.*, Jan., 1951, *55*, 11–23.

The authors report 2 cases of metastatic carcinoma to the ureter—one from the breast and one most likely from primary bronchogenic carcinoma. In addition, they review the literature and note a total of 39 cases which have previously been reported. They call attention to the rarity of this lesion and note the need for examination of the urinary tract in patients who have malignant disease elsewhere with evidence of an obstructive uropathy.—*G. W. Chamberlin, M.D.*

Squire, Fay H., and Kretschmer, Herman L. Limitations of roentgen rays in diagnosis of bladder stone. *J.A.M.A.*, Jan. 13, 1951, *145*, 81–82.

This paper is based on a review of 257 cases of proved bladder stones. It is primarily concerned with the frequency of instances in which bladder calculi are not demonstrable on the roentgenograms. Mention is made of the prevailing opinion that in a relatively high percentage of cases, one author reporting 61 per cent, bladder stones are invisible.

In 31 cases proved stones were not and could not be recognized upon review of the films, an error of 12 per cent. It has not been the experience of the authors that uric acid stones fail to cast shadows and are therefore overlooked. In 18 cases of non-demonstrable stone, in which chemical examination of the

stones was made, 13 were composed of calcium phosphate or calcium oxalate or a combination of the two. In 5 cases the invisible stones were pure nitric acid, although in 3 other cases pure uric acid stones cast positive shadows. The following factors are mentioned as responsible for visualization failure: (1) migration of stone into urethra (1 case), (2) shadow confused by the presence of a calcified fibroid, (3) failure to make a preliminary plain film, (4) sand in the bladder, (5) confusion with bowel shadow.—*C. N. Borman, M.D.*

Abeshouse, Benjamin S., and Scherlis, Irving. Spontaneous disappearance or retrogression of bladder neoplasm; review of the literature and report of three cases. *Urol. & Cutan. Rev.*, Jan., 1951, *55*, 1–11.

The authors have reported 3 original cases and collected 6 cases previously reported in which malignant bladder tumors have undergone partial regression or complete disappearance following diversion of the urinary stream, either by cutaneous ureterostomy or ureterosigmoidostomy. These changes were noted at time intervals of eight days to three months following the operation.

The authors suggest the possibility of a carcinogenic agent in the urine to account for this phenomenon.—*G. W. Chamberlin, M.D.*

Wilson, Robert. The coeliac syndrome with adolescent rickets. *Irish J. M. Sc.*, Jan., 1951, *6*, 39–42.

This case is presented because of its unusual features. The patient was born in 1928 and was well until eighteen months of age when he developed diarrhea with abdominal distention and intolerance to fats and orange juice. The diarrhea was controlled intermittently by diets deficient in the two items and the patient did fairly well until he was fourteen years old, although his growth was retarded. He then developed pain and stiffness in the arms and legs. Rickets was diagnosed at that time. It had not been present previously. The roentgen findings at this time were typical of rickets. He was treated for the next eight years with injections of calcium and vitamin D and responded quite well.

Although the deficiencies necessary for the production of rickets were present since birth, the disease did not develop clinically and was not demonstrated roentgenologically until the patient was fourteen years old. The bones must be actively growing in order to develop the recognizable roentgen changes in rickets. In this patient, the rate of growth was retarded to such an extent that the roentgen findings did not become evident until the age of fourteen when the long bones began to grow more rapidly. The rickets then flared up into a recognizable state.—*F. M. Windrow, M.D.*

Milne, M. D. Uniovular twins showing growth disparity due to renal dwarfism. *Lancet*, Jan. 27, 1951, *1*, 204–207.

A case of renal dwarfism is described in a uniovular or homozygote twin, the unaffected twin being of normal size and development. Very few cases of disparity in monozygotic twins are recorded, presumably because when both twins vary from the normal, they do so as a result of a similar deformity or disease. This case was considered of unusual interest because of the marked disparity of growth in one of uniovular twins and as an example of renal dwarfism of developmental etiology. The patient had a chronic renal failure, which was considered on clinical grounds to be due to a chronic atrophic pyelonephritis. The renal function was inadequate for demonstration of the kidneys by intravenous pyelography, and retrograde pyelography was done, it being postulated that if the patient had a congenital renal lesion it should be present in the normal twin. Intravenous pyelography on the normal twin demonstrated congenitally abnormal minor calyces which arose directly from the pelvis.—*F. E. O'Neill, M.D.*

Dreskin, E. Arthur, and Fox, Theodore A. Adult renal osteitis fibrosa with metastatic calcification and hyperplasia of one parathyroid gland; report of a case. *Arch. Int. Med.*, Oct., 1950, *86*, 533–557.

A case is presented with autopsy observations which correspond closely to the syndrome of chronic renal disease, decalcification of bone, parathyroid hyperplasia and metabolic calcification. This case is unique in that it occurred in a young adult and that only one parathyroid gland was predominantly enlarged. Because of the similarity of these lesions to those of rickets, especially on roentgenological examination, the term "renal rickets" was coined and is still widely used, despite the fact that there is no vitamin D deficiency. The condition rarely occurs in adults because endochondral bone formation has ceased, and in most cases renal insufficiency with uremia in adults becomes incompatible with life before the skeletal and parathyroid lesions have time to develop.

The present case occurred in a twenty-seven year old male with large soft tissue hard masses in his legs, arms and back. Roentgenograms revealed foci of calcification in the masses. The course of the digital arteries was also outlined with calcium. The bones of the extremities and skull were demineralized. A cystic area was present in one of the metacarpal bones, and the neck of the right femur was fractured. The enlarged parathyroid gland was removed and microscopically showed normal parathyroid tissue. Three months following the removal of the hyperplastic parathyroid gland, films revealed regression and complete absorption of the calcareous masses with regeneration of decalcified bone. Arterial calcification

remained unchanged. There was also a marked drop in the blood serum calcium and a rapid rise in the alkaline phosphatase. A severe tetany also developed. The patient died with renal insufficiency and uremia. Autopsy revealed hyperplasia of the remaining parathyroids and healing lesions of osteitis fibrosa. No evidence of subcutaneous calcifications could be found. Basically these changes are due to long standing renal disease with uremia and acidosis, and consequent alteration of the calcium and phosphorus metabolites in the blood. The phosphates are retained in the blood with resultant decrease in the serum calcium. The parathyroids are thus stimulated and the bones become demineralized with elevation of serum calcium and eventual soft tissue calcification.—*W. M. Roy, M.D.*

Nervous System

Budenz, G. C. Tuberous sclerosis, a neurocutaneous syndrome; report of a case. *Radiology*, Oct., 1950, *55*, 522–526.

Tuberous sclerosis is a rare disease with protean manifestations, involving primarily the skin and nervous system. It is considered a dysplasia of ectodermal elements and is termed neoplastic.

Outstanding manifestations are epilepsy, mental retardation and adenoma sebaceum. Some other features reported are congenital abnormalities of the palate, retinal tumors, simian hands, multiple skin nodules similar to neurofibromatosis, and various visceral tumors. Multiple polyposis of the colon is occasionally found. Cystic disease of the lung is rare. Bone lesions are frequent in the skull, but unusual elsewhere. The cranial bones usually show peculiar mottling, with indistinct islands of increased density alternating with rarefied areas. Both internal and external tables are thickened and exostoses of the inner table are usually present.

The author presents a case with osseous lesions in the calvarium, ribs, humeri and femora. Various skin lesions, a mediastinal tumor, and multiple polyposis of the colon were also present.—*E. E. Seedorf, M.D.*

Black, Boyd K., and Kernohan, James W. Primary diffuse tumors of the meninges (so-called meningeal meningiomatosis). *Cancer*, Sept., 1950, *3*, 805–819.

In a study of 4,500 tumors of the central nervous system at the Mayo Clinic only 4 primary diffuse tumors of the meninges were found. Likewise, 16 other cases found in the literature since 1927 are thought to be well enough substantiated to be included in this report.

The authors recognize two types of cells in the meninges which are involved in the formation of tumors. These are the arachnoid cells and the connective tissue elements. They hold that either of these components separately or as an admixture of both may form the neoplasm. Likewise, they feel that solitary or multiple discrete tumors and primary diffuse tumors of the meninges represent the same fundamental neoplastic process. Although both elements may show benign or malignant tendencies, relatively few primary diffuse tumors with benign characteristics are encountered as contrasted with the usually benign solitary meningiomas.

Of the 4 primary diffuse tumors of the meninges from the Mayo Clinic reported in detail 2 tumors were of the meningothelial cell type as were 6 cases from the literature; 1 tumor was derived from fibroblasts as were 6 from the literature; and 1 tumor was of the mixed type as were 4 from the literature. These diffuse tumors arise spontaneously in large areas of the arachnoid and it is not necessary to explain their origin as resulting from embryological nests as is the view of some authors.

Medulloblastomas present considerable difficulty in differential diagnosis but diffuse tumors must also be differentiated from carcinomatosis, metastatic sarcomatosis, melanomatosis, and primary sarcomas.

The authors suggest the use of the following terms to specify the type of meningioma in question: (1) solitary, multiple or diffuse; (2) malignant or benign; (3) meningothelial, fibroblastic or mixed. In addition, meningiomatosis is used to designate the primary diffuse type.—*D. E. Vivian, M.D.*

Jefferson, Michael. Laterally placed cervical discs; review of twelve cases. *Lancet*, Jan. 20, 1951, *1*, 129–132.

Lateral rupture of cervical discs is now recognized as occurring more frequently than central protrusion. Brachial neuralgia of radicular type is more common than the syndromes of spinal cord compression.

In the 12 cases, signs of damage to C_7 root occurred almost twice as often as signs of damage to C_6 root. D_1 root was only once affected. No unequivocal examples of injury to higher cervical nerves by disc herniation were found.

Three common radicular syndromes can often be distinguished on clinical grounds fairly accurately, depending upon the location of the lesion at C_6, C_7 or D_1. The author gives a detailed description of the clinical findings.

Straight roentgenography of the cervical spine in patients with radicular neuralgic complaints is not always helpful or reliable. Many apparently normal people over forty years of age show roentgen evidence of degenerative arthritis of the neck. These changes are usually present in the lower cervical region and very often show definite narrowing of the discs at one or more levels. Yet these patients are symptom-free. Conversely, it is well known that the absence of roentgen signs in the neck cannot be taken to mean that the intervertebral discs are healthy. Two of the 12 cases reported gave normal cervical roentgeno-

grams. One of these had a protrusion at C_5-C_6 found at operation and the other had clinical signs of prolapse of C_6-C_7. In only 6 of the cases reported did the roentgen signs coincide exactly with the level of root compression as determined clinically, myelographically or operatively.

The author stresses conservative treatment before resorting to surgery. He advises plaster immobilization of the neck, including the head and upper chest. Physiotherapy is also used. Operation should be reserved for those patients whose symptoms are of long duration and are known to resist more modest courses of action.

There is a good bibliography.—*C. P. Truog, M.D.*

Uhlemann, H. J. Uber Wurzelkompressionssyndrome bei Osteochondrose der Halswirbelsäule; (ein Beitrag zur Differentialdiagnose der Brachialgien). (Nerve root compression syndrome in osteochondrosis of the cervical spine; contribution to the differential diagnosis of the brachialgias.) *Deutsche med. Wchnschr.*, Jan. 12, 1951, *76*, 37–41.

The work of the author is based on observations published by Duus and Kahlau in 1948, according to which narrowing of the intervertebral foramina by osteoarthritic changes in the cervical spine frequently produces a syndrome of irritation or paresis of the cervical plexus with pain and muscular atrophy.

A series of 50 cases is reported with a summary of the salient clinical and roentgenographic findings and of the type of treatment applied.

Extension with Glisson's sling or a plaster jacket, and in some cases operative removal of the exostosis causing compression, produced good results.

The article contains 35 references.—*K. E. Matzinger, M.D.*

Lindblom, K. Technique and results of diagnostic disc puncture and injection (discography) in the lumbar region. *Acta orthop. Scandinav.*, 1951, *20*, 315–326.

Objections have been made to disc puncture because of supposed secondary destruction and rupture of discs. However, re-operated disc cases in which discs were punctured during the first operation did not show any rupture or protrusion at a second operation. Also, 24 disc punctures with injection of diodrast in 4 dogs' tails did not show any macroscopic or microscopic changes after seven days to four months.

Nevertheless, disc puncture is a procedure which should be reserved for preoperative localization of disc pathology. It is superior to myelography in that the disc responsible for specific symptoms can be identified.

Transdural midline punctures can be made in the three lower lumbar discs. In the first two, a puncture from the posterolateral side is possible, and cervical discs have been punctured from the anterolateral side.

For a transdural puncture, on a lateral roentgenogram the distance from the skin to the disc center is measured with the aid of a centimeter scale attached along the line of the spinous processes. A double needle of a suitable length is inserted, the outer needle into the spinal canal and the inner needle (0.5 mm. in diameter) into the center of the disc. A mixture of 2 cc. 35 per cent diodrast and 0.5 cc. 5 per cent novocaine is injected.

With the patient lying prone, but slightly oblique, on pads to overcome lordosis, the needle is inserted at the side of the intraspinous ligaments through a point on the skin marked during fluoroscopy. The puncture is completed under fluoroscopic control. When the needle reaches the posterior longitudinal ligament and the posterior surface of the disc, more than slight pain indicates that an offending disc is being entered. With the needle in the nucleus, the contrast medium can be injected readily. The cavities in a normal disc are entirely filled by 0.5 cc. while a ruptured disc can take more. Distention of the disc produces pain. In a normal disc and in an asymptomatic ruptured disc, there is a mild back pain at the puncture level. Distention of the offending disc reproduces the patient's usual low back and sciatic pain. Usually two or three discs have to be punctured for correct evaluation.

The normal discogram has two dye-filled spaces, one along the upper and the other along the lower vertebral margin, outlining the nucleus and not projecting into the annulus. The two layers are joined by an irregular streak of dye through the center of the disc, producing a "collar button" appearance.

The pathological discogram shows varying degrees of projection of the dye into or through the annulus and varying degrees of diffusion of the dye. The article is well illustrated.—*George Cooper, Jr., M.D.*